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DOUGLAS FRESHFIELD
1845–1934

BOTH the Royal Geographical Society and the Alpine Club have lost the last outstanding figure of their Old Guard. Douglas William Freshfield was born on 27 April 1845, the only son of Henry R. Freshfield, Solicitor to the Bank of England. He was in Wolley-Dod's House at Eton and at University College, Oxford, taking Honours in Law and History in 1868. He was called to the Chancery Bar, but did not practise, having had the command of ample means all his life. Few men knew better how to spend.

As a child and up to his undergraduate days he travelled with his parents on their summer holidays in what were then out-of-the-way parts of the Swiss and Italian Alps, parts which in several instances, owing to the subsequent concentration of tourist traffic along railways and motor roads, are still the most unspoiled quarters of the Delectable Mountains. His earliest journeys were recorded by his mother (Jane Crawford) in 'Alpine Byways,' by "A Lady" (1861), and 'A Summer Tour in the Grisons' (1862), both volumes still full of charm to those who know the country.

While yet at Eton, Freshfield crossed the Col du Géant and ascended Mont Blanc. He had previously climbed the Titlis and the Cima di Jazzi, and crossed the St. Théodul and the Monte Moro with his parents. In the following year, with two friends and François Devouassoud of Chamonix, who became his lifelong climbing companion and friend, he walked across many passes and peaks in a journey recorded in a privately printed Journal entitled 'Thonon to Trent' (1865), now so sought after by collectors, usually in vain. Among his first ascents were the Basodino, Piz Valrhein, and the Presanella—the loftiest of the Lombard Alps. In 1865 he was one of a strenuous party led by F. F. Tuckett, which made a great number of new expeditions in the Dolomites, Tyrol, and Eastern Switzerland. During the sixties and seventies he made at least twenty first ascents, mostly in the Italian Alps, but spreading from the Dolomites to the Maritimes. In 1875 he published the 'Italian Alps,' proclaiming those beauties which are still only appreciated by

that minority of British mountaineers who still find there a refuge from the overcrowded peaks and sophisticated valleys of the better known Swiss and French centres.

Going down from Oxford in 1868 he began his career as a traveller by visiting the Nearer East—Egypt and Palestine, including in the latter the then rarely accessible "Giant Cities" of the 'Handbook' of Porter and Murray, and Roman remains mostly of the time of the Antonines in the Druse highlands east of the Jordan and south of Damascus. From Constantinople he went by sea to Poti and Tiflis, and on through Armenia to Mount Ararat and Tabriz in Persia. On his return to Tiflis he made an attempt to climb Ararat which was defeated by a late snowfall. Thence, with C. Comyns Tucker, A. W. Moore, and his inseparable François Devouassoud, he started on a serious attempt to explore the recesses of the Central Caucasus. The character of the chain was at that date (1868) unknown to European geographers and misrepresented on maps and text-books. Even the existence of glaciers was doubted. Its peaks were all unclimbed and many of the highest unmapped and unmeasured. Midway between Kazbek (16,546 feet) and Elbruz (18,470 feet), both of which were ascended for the first time, the explorers came upon a group three of the summits of which approached 17,000 feet. Their bases were found to be surrounded by great glaciers rivalling those of the Alps in grandeur. In 1887, and again in 1889, Freshfield returned to the Caucasus. The latter journey was undertaken to ascertain the fate of his friends W. F. Donkin and H. Fox, who had disappeared in 1888 while climbing in the heart of the chain. He found their last bivouac. One result of these journeys was a map of the Central Caucasus indicating its peaks, passes, and glaciers. This was constructed from the material collected by the travellers by Mr. Reeves, for so many years our Instructor and Map Curator. This map was included in two important volumes, 'The Exploration of the Caucasus' (1896), a masterpiece of mountain literature, written in scholarly style, objectively, describing the mountains and their peoples and with no trace of self-glorification, despite the fact that he had Kazbek, Elbruz, Gulba, and the glorious cone of Tetnuld to his credit amongst other first ascents. Only a week ago one of the most eminent of young German mountaineers, discussing some of his own remarkable ascents in the Caucasus with the writer of this notice, commented on the fact that Freshfield's was still the best map of the Caucasus available to mountaineers.

In 1899 he visited India, Burma, and Ceylon, accomplishing his second greatest journey of exploration by the first circuit of Kangchenjunga. He was accompanied by Professor Garwood, who produced a map which is still the best for the whole district, though portions of it have naturally been improved upon. This expedition was recorded in 'Round Kangchenjunga' (1903), a work beautifully illustrated by the photographs of his companion, Cav. Vittorio Sella, again written in a style achieved by few recent writers of Himalayan narratives.

His last great journey was made at sixty years of age. Returning from the meeting of the British Association in South Africa in 1905, he landed at Mombasa with the late A. L. Mumm, then honorary secretary of the Alpine Club, and proceeding through Fort Portal made an attempt on Ruwenzori,

at that date the still mysterious Mountains of the Moon. He struck a bad time of year, and perhaps more than usually disastrous weather: continuous rain and dense cloud with endless mud practically immobilized them at 12,000 feet, and but little was accomplished beyond the endurance of great discomfort and hardship.

In 1913 he made a tour of the World, including visits to the Japanese Alps and the United States. He also paid two visits to British Columbia. At different times he visited little known parts of Dalmatia, Spain, the Pyrenees, Algeria, and all parts of Italy, where he indulged his hobby of collecting works of art with an informed discretion. He also revisited the Alps frequently and made tours in Sweden, Norway, Denmark, Russia, Greece, Corsica, Bosnia, and Portugal. Many of these excursions, almost always made with his guide and friend François Devouassoud, are narrated in 'Below the Snowline' (1923), one of the gems of mountain literature. Had it not been for the Great War he would have undertaken an ambitious and formidable journey to Chinese Turkistan—in his seventieth year!

But travel was only one side of his geographical work. As Dr. H. R. Mill has written in *The Times*, Freshfield was really responsible for persuading our Society to detach the late Sir John Keltie, of happy memory, from journalism and to send him to study geographical teaching on the Continent. Keltie's report formed the basis of the modern English outlook on geographical teaching. Freshfield saw that recognition of geography by the Universities was essential to secure a supply of competent teachers. It was his advocacy which led our Society to subsidize geographical teaching at Oxford in 1888 and at Cambridge in 1903. This cost our Society some £20,000; but there is now no University in Britain without a School of Geography. It is perhaps the greatest work we have accomplished, for exploration would have gone on somehow even had our Society never existed, but without those efforts of ours, which Freshfield fathered, it is improbable that Geography would even yet have become an Honours subject, with all that that implies in outlook and teaching and teachers. It is also noteworthy that as Honorary Secretary of the Society he gave evidence before a Departmental Committee in favour of improvements in our Ordnance Map. His suggestions were resented at the time in official quarters, but have since been adopted and carried out.

He had been admitted a Fellow of the Society by Sir Roderick Murchison in 1869. From 1881 to 1894 he was one of our honorary secretaries. His powers of organization and abilities made his tenure of office memorable. He founded our collection of photographs. He was revolutionary enough to introduce the use of the lantern to illustrate lectures in opposition to the views of those who feared we should degenerate into a merely "popular" institution. He was the godfather of the *Geographical Journal*, which replaced our more stolid *Proceedings*, in which illustrations had been considered out of place. To him is due the recognition of the place of mountaineering in exploration, and he was the mover in the award by our Council of Gold Medals to Hooker, Whymper, the Duke of the Abruzzi, and Lord Conway. His early interest in the Mount Everest problem and his contributions to the *Journal* directly led to those expeditions of which the last has just returned, and he was still an extra member of the Mount Everest Committee at the time of his death.

In 1893 he succeeded in gaining the election of women to the Society, but the precedent was defeated by Lord Curzon, who was destined to revive that reasonable policy during his own later Presidency. He received the Livingstone Medal of the Royal Scottish Geographical Society, and was awarded our own Founder's Medal in 1903. He was our President from 1914 to 1917. It was a matter of regret to many of us who were absent during those years that his Presidency should have occurred during the War, but he at once placed the whole resources of the Society at the disposal of the War Office, and amongst other work we were more particularly responsible for the production of many sheets of the 1/Million map which were invaluable both during the War and at the Peace Conference.

This by no means disposes of his record of service to geography. In 1883 he was Joint Editor of three editions of the Royal Geographical Society's 'Hints to Travellers,' and editor of two editions of Murray's 'Switzerland.' For sixty years he contributed to our publications. Besides papers on his principal explorations he wrote articles on "The Conservative Action of Glaciers," on "The Alpine Frontiers of Italy," on the "Mountains of Dante," and on many other matters connected with mountaineering or geography, while an address on "Men and Mountains," given as President of the Geographical Section of the British Association at Cambridge in 1904, has been more than once reprinted in Great Britain and in the United States. For thirteen years he was Chairman of the Geogiaphical Association which was instituted to carry on that improvement in education set on foot by the action of the Royal Geographical Society's Council. In 1924 he received the well-earned honour of being appointed Trustee to our Society.

His services to the Alpine Club were no less remarkable and generous. Elected in 1864 he was its oldest member at the time of his death. All his life he was a constant attendant at their meetings and a speaker who was always listened to with respect. He served on the Committee first in 1869. He edited the *Alpine Journal* from 1872 to 1880. He was elected Vice-President in 1878 and President in 1893. It will be news to many, but it was very typical of the man, that it was quite hard to get him to accept nomination. He said, "I am not the sort of man you want"; "I'm the most unpopular member of the Club"; but the Club rather liked his controversial rapier and knew that his sharpest thrusts were not really malicious: they were nearly always thoroughly well deserved, and he was never one to score a dialectical point with any quibbling half-truth. It is true that some of our youngest generation of climbers resented his widely recognized authority and his not always veiled criticism of some modern characteristics. But the writer will maintain that his mind retained a youthful receptiveness to the end. In those last days, while his indomitable spirit was escaping from the bonds of the body, he would speak of the last Mount Everest Expedition and called repeatedly on François, companion of a thousand days, to bring him his (climbing) boots because he must be getting ready for yet another journey. He was an honorary member of most of the foreign Alpine Clubs, where his reputation stood as high as it did with us. His great 'Life of de Saussure' (1920), written with the collaboration of the late Henry F. Montagnier, was rewarded with a doctorate by the University of Geneva, and a French edition was called for

in 1924. He also published an essay on Hannibal's passage of the Alps, 'Hannibal Once More' (1914), and a short volume of verse, 'Unto the Hills' (1914). A further collection of occasional rhymes, 'Quips for Cranks,' was privately printed in 1923, for he thought some of the leg-pulls too personal for publication. To his exertions was due the moving of the Alpine Club's headquarters from the old rooms in St. Martin's Lane to its present excellent quarters in Savile Row, which he did much to beautify at his own expense. Yet Freshfield was never a great climber in the technical or gymnastic or acrobatic sense. He was essentially a mountain explorer. His reputation as a mountaineer will rest on the pre-eminent quality of his "mountain sense," on his path-finding power, on his unrivalled ability for disentangling mountain topography and giving a clear and objective account of it. In these fields he was unrivalled. His reception on the last occasion in which he spoke at a meeting of the Alpine Club was of a character that can only be described as an affectionate ovation.

Although the dominating interest of his life was mountain exploration, and though he continuously devoted his leisure to the affairs of the Royal Geographical Society and of his beloved Alpine Club, he found time for many other activities. He served for several years as Treasurer of the Hellenic and Roman Societies, and as Chairman of the Committee of the Society of Authors. He also spent much time working for the C.O.S., for he was the most charitable of men, though his good deeds were done by stealth. Neither did he shirk his local duties, being a Justice of the Peace for Sussex, a Conservator for Ashdown Forest, and for many years Chairman of the Forest Row Committee of that Board, always doing his utmost to protect the Forest from that vandalism which is so ruthlessly invading our countryside. During the War he lent, and administered, Wych Cross Place as a hospital. This beautiful house, designed by his talented son-in-law, Edmund Fisher, who died on military service during the War, was far more than a museum of artistic treasures collected during a lifetime, for every piece seemed to have been designed to fit its own particular place, a rare testimony to the impeccable taste of its owner. The siting of the house, the fading out of the beautiful terraced garden into the natural forest, displayed the soul of the artist.

Let us speak of the man himself, known to the writer for thirty years, since old days at Campden Hill, and known for his charm! So shy, so cordially hating self-advertisement, so despising self-advancement, so modest that it was hard to get him to speak at all of his own exploits. Yet he was generally considered proud, a great fighter and a keen controversialist, caustic in his sarcasm, not able to suffer fools gladly. But in reality he was kindness itself. To those who knew him his malice was but a jesting mood. His courteous manner towards the junior members of the staff of our Society is remembered with gratitude. With those younger men who had the privilege of his acquaintance there was never the faintest trace of the superior air of great experience, still less of condescension. Conversation with him on almost any subject was a delight. He was an accomplished scholar. Probably his most cherished honour was the Fellowship conferred by his old College and the D.C.L. of his University. His translations from the Greek are delightful. His knowledge of literature was encyclopaedic. His knowledge and appreciation of Art

were no less remarkable. He was a cultivated Victorian. Though he had no scientific training his intellectual equipment was such that he could more than hold his own in that field of discussion also. He knew all the great men of his time; but again and again his innate modesty would curb his reminiscence and he would tantalize the listener by branching off on to some other of his many interests. His tall figure, upright to the last, and his resonant voice made him an object of attention everywhere. He was a great gentleman. To some of us he revealed a charm of manner—and a youthfulness of mind to the end—that turned our admiration of his experience, judgment, and knowledge into a personal affection, so that his death leaves a sense of loss unusual in the case of a generation that only knew him as an old man.

In 1869 he married Augusta Charlotte, daughter of the Honble. W. Ritchie, Advocate-General of Calcutta, who died in 1911. He had a son who to his everlasting grief died in boyhood, and he leaves four daughters. To these we have already expressed our grief and sympathy by resolution of Council endorsed by the Fellows at the subsequent evening meeting of the Society. It is indeed a break and a passing hard to realize by those who were privileged to know the man.

T. G. Longstaff

NORTHERN RHODESIA–BELGIAN CONGO BOUNDARY: *A paper read at the Evening Meeting of the Society on 5 February 1934, by*

LIEUT.-COLONEL E. R. L. PEAKE, M.C., R.E.

THE Congo–Rhodesia boundary was defined by the Agreement of 12 May 1894 as follows: "The frontier between the Independent Congo Free State and the British sphere to the North of the Zambezi shall follow a line running direct from the extremity of Cape Akalunga on Lake Tanganyika, situated at the Northernmost point of Cameron Bay at about 8° 15′ South Latitude, to the right bank of the River Luapula, where this river issues from Lake Moero. This line shall then be drawn directly to the entrance of the river into the lake, being however deflected towards the South of the lake so as to give the Island of Kilwa to Great Britain. It shall then follow the thalweg of the Luapula up to its issue from Lake Bangweolo. Thence it shall run southwards along the meridian of Longitude of the point where the river leaves the lake to the Watershed between the Congo and the Zambezi, which it shall follow until it reaches the Portuguese frontier."

From this it will be seen that the boundary comprises five distinct sections: (i) the Mweru–Tanganyika strip; (ii) Mweru Lake; (iii) the Luapula river; (iv) the Meridian Section; (v) the Congo–Zambezi Watershed Section.

We are concerned here only with sections (i), (iv), and (v).

In 1911 an Anglo-Belgian Commission was formed and was given the task of demarcating this boundary. I will summarize what they accomplished between September 1911 and August 1914, in order to help later in making it perfectly clear why their work had to be re-done by the 1927–33 Commission.

Between lakes Mweru and Tanganyika the country was surveyed topographically by both the British and Belgian parties working independently, but the boundary itself was not demarcated, principally, I presume, because the outbreak of war put an end to the Commission but also because there was some doubt about the eastern terminal on Lake Tanganyika. A map of the country surveyed by the Commission in the Mweru–Tanganyika area was published by the War Office in 1916 to a scale of 1/250,000 (G.S.G.S. 3338).

Both sections of the Commission, again working independently, carried out a topographical survey of the area stretching from the southern shore of lake Bangweulu to and overlapping the Congo–Zambezi watershed and extending to a mean distance of about 30 miles on either side of the Mpanta Meridian, Mpanta being the point at which the river Luapula was supposed to leave lake Bangweulu. The British Survey was drawn and printed by the War Office in a 3-Sheet Series No. G.S.G.S. 2712 in 1914. No demarcation of the boundary was carried out, again presumably owing to the outbreak of war.

The only section of the boundary that was actually demarcated on the ground was that portion of the watershed lying between Boundary Pillar 11, in the neighbourhood of Ndola and B.P. 46, at the junction with the Angola boundary. It was this section of the boundary that was described by Major Steel in the paper he read before this Society on 18 June 1917. Their method of demarcation consisted in erecting boundary marks at intervals varying between 10 and 30 miles along the watershed, which had been located pre-

viously by means of a topographical survey. The boundary marks were composed of 5- to 6-foot lengths of 6-inch iron piping with a flange at the end, buried in the ground; to be precise they were the bottom ends of telegraph poles of the collapsible type used throughout Northern Rhodesia.

The country to a distance of about 10 miles on either side of the watershed was covered by the topographical survey, which was later drawn at the Ordnance Survey and was published by the War Office in a 5-Sheet Series No. G.S.G.S. 3744 in 1924. Sheet No. 1 of this series overlapped Sheet No. III of the Bangweulu set, in the neighbourhood of the Musendika Hills.

At the outbreak of war the British Section of the Commission was recalled, while the Belgian Section on their own account erected the remaining Watershed Pillars Nos. 1 to 11, the former being at the southern end of the Meridian Section. As before these pillars were erected at unequal intervals along the boundary, but in this case the distances varied between 5 and 25 miles. Thus along the whole 600 odd miles of watershed boundary only forty-six pillars were erected. While they themselves were very inconspicuous and difficult to locate in thickish bush, there was nothing more to show one on the ground how the boundary ran. In general between B.P. 11 and B.P. 46 the country is extremely flat, and in most cases one's estimate of the position of the watershed might be quite a few miles in error. Between B.P. 1 and B.P. 11, where the country is hilly and much more cut up, the watershed was more obvious, though even here one might be quite badly out in some cases.

If the best part of the watershed had not been found to be highly mineralized the probability is that the early demarcation would have held good for many more years than it did. As it was, within six or seven years after the war, when Concession Companies were busy opening up the copper belt on either side of the border, the question as to how the boundary ran was continually arising, as it was bound to do. The most notable case was that of Kipushi, an extremely rich mine on the Congo side of the border; as before the exact location of the watershed at this point was doubtful, owing to the flatness of the country, and the companies holding concessions on either side had to tread warily so as not to encroach into their neighbour's country, their activities being badly hampered thereby.

I think it was this particular case that at length brought matters to a head, and on representations from the Mining Companies the British and Belgian Governments were prevailed upon to settle the question once and for all by sending a boundary commission to demarcate very much more closely than before the run of the boundary through the copper belt. The agreement between the two Governments signed on 19 March 1927 clinched matters, and about the middle of July in the same year both sections of the Commission foregathered in Elisabethville, where preparations were made for the field. Lieut.-Colonel D. Cree, R.E., and Colonel Gendarme were the senior British and Belgian Commissioners respectively.

Starting towards the end of August 1927 and concentrating first on the stretch of boundary opposite Kipushi the Commission completed the demarcation of the watershed between B.P. 11 and B.P. 33 by the end of October 1929, Lieut.-Colonel Cree having been relieved by Lieut.-Colonel A. B. Clough, R.E., at the beginning of May 1928.

The field activities of the Commission ceased in November 1929, when the European personnel, with the exception of a small cadre, consisting of Lieut. Swettenham, Sergt. Burne, and Corpl. Biggs, the Commission Clerk, who were left behind to look after the stores and transport, returned to Europe. The new British and Belgian parties formed to relieve those who had gone home sailed for Cape Town at the end of February 1930, eventually arriving at Elisabethville at the end of March. The British Section now consisted of myself in command, Captain A. W. Heap, R.E., and Lieut. Swettenham, R.E. (assistant commissioners), Dr. F. W. Gilbert (medical officer), 4 N.C.Os., R.E. (surveyors), 1 N.C.O., R.E. (clerk), 1 N.C.O., R.A.S.C. (mechanic), and Sergt. Burne of the Northern Rhodesia Regiment (or Northern Rhodesia Police, as they were called at that time) in charge of the Askari escort.

Colonel Gendarme returned again in command of the Belgian Section, and with him were Assistant Commissioners Captain G. Letenre and Monsieur Sterpenich, with four technical assistants and a warrant officer in charge of the Belgian escort. Before going further I would like to say that our relations with the Belgian Section of the Commission were always most cordial. Colonel Gendarme had, I believe, served on every International Commission formed to demarcate the frontiers of the Belgian Congo. He had been a member of the 1913 Rhodesia–Congo Boundary Commission, and his knowledge of the boundary area was of inestimable value to the present Commission.

In addition to completing the watershed demarcation the Commission was now empowered to investigate also the Meridian and Mweru–Tanganyika Sections.

Before leaving for the field we spent three hectic days in Elisabethville, where we were given a splendid reception and were entertained most hospitably by the Governor of Katanga and by Colonel Gendarme. With the latter we visited Lubumbashi, the headquarters of the Union Minière du Haut Katanga, where ore from the neighbouring copper mines is smelted. Just before the war Elisabethville consisted of a few huts in the middle of the bush, and Major Steel's photograph of the "Zambezi Express arriving at Elisabethville" gives one a good idea of what it must have been like. It is now a large city of several thousand European inhabitants. It is beautifully laid out, the roads are for the most part tarred and bordered with jacarandas and other flowering trees, the buildings are modern and built of concrete: a wonderful place to find in the midst of limitless bush.

During the hiatus from the time the first party sailed for home to when we arrived, the cadre left behind had been kept busy building a new base camp at the head of the Niankasa stream near B.P. 34, to which they transferred all the Commission stores and instruments from Lunda, Lieut.-Colonel Clough's last base camp on the Elisabethville–Kansanshi road. Our two days' journey between Elisabethville and the Niankasa Base Camp gave me a very good idea of what Lieut. Swettenham and his party must have had to contend with in moving the Commission stores to Niankasa. The rains were at their height and the roads at their worst. They appeared to consist of an endless string of large mud-holes each connected to the next by a short strip of sounder road which threatened to become a bog-hole itself at any moment. The stretch of road between Kansanshi and Niankasa was particularly bad, and we passed

several parties out repairing and corduroying the worst bits. Our average speed between Elisabethville and Niankasa worked out at something under 7 m.p.h.

At Niankasa we found everything ready for us, living huts for ourselves, officers' and N.C.Os.' messes, an office, store huts for survey gear and mess, garages and workshops for the mechanical transport, and lines for the Askari escort and carriers.

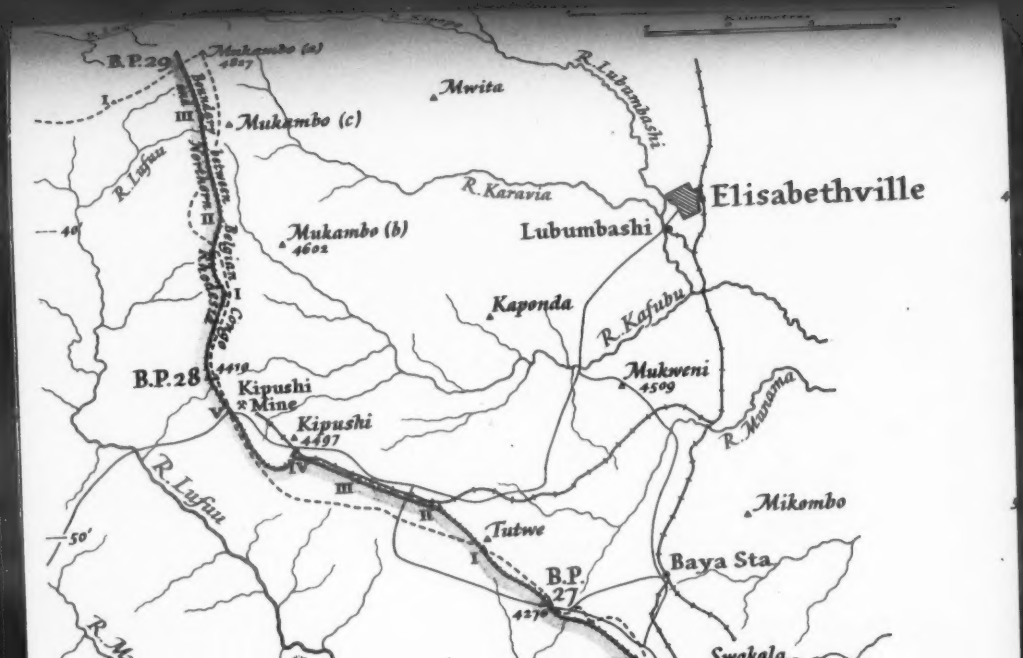
Work on the boundary started immediately. Although officially the previous year's work had ended at B.P. 33, the British Section had had time to locate and clear the boundary cut on to B.P. 34, so it was at the latter point that my party commenced their labours. Briefly the work we had to do along the watershed section of the boundary was first to locate the watershed, and then to clear a 5-metre lane through the bush along our location. Along the centre of the lane a path of about half a metre wide was hoed, main boundary pillars were erected at intervals of about 5 kilometres along the boundary path with intermediate or auxiliary pillars at intervals of about 500 metres, adjacent pillars being inter-visible. Thus the boundary consisted of a series of straight lines each roughly 500 metres in length, with pillars at the junctions.

An auxiliary pillar consisted of a 2-foot iron pipe sunk flush with the ground and filled with cement in which the cartridge case survey mark was embedded. Over the pipe a cairn of stones was erected and a circular ditch about 18 inches deep surrounded the whole. Main boundary pillars were of concrete, and nearly 1½ metres in height; in plan they were square with a side of 1 metre at the base and tapering slightly towards the top. A square ditch surrounded each main pillar.

The watershed between B.P. 34 and the Angola border is very flat, and it is impossible to determine the line of it by eye. The method of locating the true water-parting was by running sections of levels at right angles to the boundary and joining up the highest points of these sections. Even then it was not really a particularly easy matter to decide on the highest point, because the heights were thrown out in many cases by the colossal anthills which dot the country along the watershed: they run up to 20 feet in height and about 30 feet in diameter at the base. They are covered with grass and bush, and quite different from the normal type of anthill, which is nothing but a heap of mud. I have been told that they were made ages ago by a brand of white ant which is now extinct; how true this is I do not know, but in any case they are not active, even though white ants must infest them just as they infest every other square inch of Northern Rhodesia.

Having located and cleared a section of boundary the next job was to survey it in order to fix its position on the face of the earth. Briefly our methods were as follows: At the commencement of their work the 1927 party had based their ruling triangulation on the Tshinsenda Base, which had been connected to the Rhodesian Arc by the 1912–13 boundary triangulation. They had extended their triangulation westwards very largely along the line of the 1913 boundary triangulation, as far as the side Itembe-Chantete, bestriding the boundary between B.P. 33 and B.P. 34.

Where possible every main boundary pillar was connected by a small triangle to the ruling triangulation. This was done by erecting a signal on the nearest or most convenient anthill and by cutting rays through the bush to


B.P.29
Mukambo (a)
4827
Mwita
R. Lubumbashi
Mukambo (c)
R. Lufuu
R. Karavia
Elisabethville
Lubumbashi
Mukambo (b)
4602
Kaponda
R. Kafubu
B.P.28
4419
Kipushi
Mine
Kipushi
4497
Mukweni
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R. Manama
R. Lufuu
Mikombo
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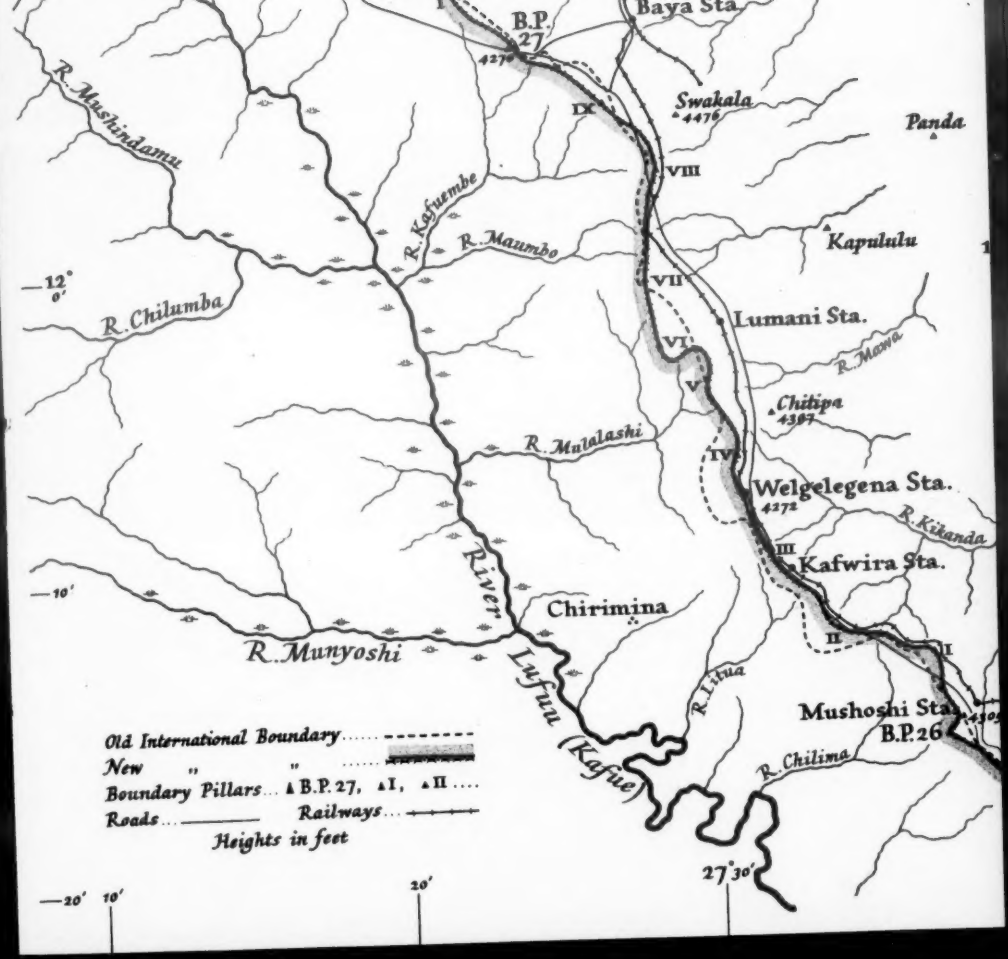
Baya Sta
B.P.
27
4270
40'
50'


B.P. 27
4270
Baya Sta.
Swakala
4476
Panda
Kapululu
Lumani Sta.
Chitipa
4307
Welgelegena Sta.
4272
Kafwira Sta.
Chirimina
Mushoshi Sta.
B.P. 26
R. Mushindamu
R. Kafuembe
R. Maumbo
R. Chilumba
R. Mana
R. Mulalashi
R. Kikanda
R. Munyoshi
River Lufuu (Kafue)
R. Litua
R. Chilima
IX
VIII
VII
VI
V
IV
III
II
I
12° 0'
10'
20'
27° 30'
Old International Boundary
New " "
Boundary Pillars ▲B.P. 27, ▲I, ▲II
Roads
Railways
Heights in feet

the direction of two points of the ruling triangulation which, with the B.P. station in question, gave the best-conditioned triangle. The rays were continued until the distant signals and the B.P. signal were intervisible. A land connecting the B.P. to its trig. station was then cleared and a path similar to the boundary path was hoed between the two.

In some cases of course it was not possible to find any point near the B.P. from which two outside trig. points were visible, but we worked to the rule that no two such main boundary pillars that had not been connected to the ruling triangulation should follow each other. Thus the geographical position of at least every other main boundary pillar was known. A normal theodolite traverse with measurements of distance by steel tape along the ground was next run along the boundary paths from every boundary pillar trig. station to the next one west of it. Each of these traverses was adjusted to the values of the starting and closing stations, and the Cassini rectangular co-ordinates of each auxiliary pillar or traverse station were computed with the starting station as origin, the geographical co-ordinates of the boundary pillars themselves being deduced.

Thus the final survey values along the boundary consisted of: (1) the geographical co-ordinates of the main boundary pillars; and (2) the Cassini rectangular co-ordinates of both main and auxiliary boundary pillars, each point being referred to the main boundary pillar immediately to the east of it as origin.

We were able to continue our ruling triangulation to the neighbourhood of Pempere (B.P. 36) without any difficulty. Beyond this point and as far as B.P. 38 there is a high plateau over which we found it impossible to extend our triangulation without the aid of towers. It was in this area that the British triangulation of 1913 left the boundary and was taken due west to join the Anglo-Portuguese Boundary Commission triangulation at Mwinilunga, while the Belgian chain was diverted into the Congo touching the boundary once more only at B.P. 39. Beyond B.P. 36 and as far as the Angola border the watershed is devoid of the isolated hills that had made the triangulation an easy matter up to then. It was a question now whether we should continue, using towers and tree stations, or whether we should abandon triangulation and resort to some type of precise traverse. We could not do as the earlier Commission had done because we wanted our control near enough to the boundary to enable us to fix the positions of the main boundary pillars. The distance along the boundary from Pempere to the Angola border is about 200 miles, certainly a very formidable distance to traverse to an accuracy comparable with that of secondary triangulation. But the Gold Coast Survey Department had shown what could be done with specially made catenary traverse apparatus, and Mr. Clendinning, their surveyor-general, very kindly placed all their experience at our disposal should we decide to discard triangulation for traverse. Taking all things, especially expense, into consideration it was decided to adopt the Gold Coast methods of primary traverse with suspended tape.

Up to B.P. 36 it had been customary for both sections to traverse the boundary independently, the means of the two sets of values being taken as final. But we flinched at the last moment at the idea of 200 odd miles of traverse and decided to split the distance equally, each section taking half.

We started catenary work about the middle of October 1930, and working right through the rains, finished up at B.P. 46 on the Angola frontier about the middle of March 1931. As control for direction astronomical azimuths were observed at roughly every other main boundary pillar throughout the catenary traverse. A few notes on our Catenary Traverse arrangements are given in Appendix I.

Generally speaking, Northern Rhodesia and parts of the other countries bordering it are covered with bush or forest, the height of the trees varying from about 12 feet to 60 feet, though the average is round about 30 feet. It always seemed to me rather wonderful that trees grew there at all, because the soil seemed to consist chiefly of fine white sand, though of course there are areas where there is little or no sand. Here the soil is red and presumably moderately fertile, though I somehow doubt if there is any really fertile spot in Northern Rhodesia. The soil in the valleys which should surely be the richest is quite the reverse. It is black and slimy and grass is about the only thing that will grow in it, the normal bush ending abruptly some distance from a watercourse; though on the banks of most rivers there are odd patches of tropical jungle called Mteshi Bush, with tall straight trees up to about 50 feet in height and thick undergrowth. The ground this bush grows in is usually bog. In one of our camps we made the mistake of trying to grow our vegetables just on the rim of one of these *dambos*, as they are called in Northern Rhodesia, and we got practically nothing back for our pains. Sometimes in the *dambos* there are some of the large anthills I have mentioned before, and these are covered with bush, probably because the soil composing them has been brought up from some distance underground by industrious ants, and is quite unlike the sour mud of the *dambos*. The natives understand this quite well, because one noticed that they preferred to plant their gardens on the slopes of anthills than elsewhere. On the whole there is very little undergrowth, and one can walk pretty well anywhere except through the Mteshi Bush without being impeded to any extent; though at certain times of the year both grass and bracken have to be reckoned with.

In October, towards the end of the dry weather and when most of the grass and dry leaves and other bush rubbish have been consumed by the various bush fires, most of the trees begin to get their new foliage. This is usually a shade of crimson to start with, changing through orange and yellow to green later. It seems curious that new leaves should sprout after five months of hot, rainless weather, but their colours are even more amazing. A landscape of nothing but reds and yellows is a truly wonderful sight.

The average altitude of the watershed is about 4500 feet above M.S.L., and although we were within 11° of the Equator we found it very cold during the winter months of June and July. In the base camps we usually kept our huts warm by fire buckets or braziers made out of 4-gallon petrol tins, live charcoal from the camp fire being the fuel used.

The old traction road which had been used by Major Steel's party had not been allowed to disappear, and when we came on the scenes we were able to locate it and open it up. The Kansanshi–Niankasa road, which I have spoken about already, was part of the old traction road. It was really nothing more than a cutting through the bush with the tree stumps removed, so it was

One of the 1913 boundary marks on the top of an anthill

Elisabethville railway station

The original boundary pillar No. 1 at the junction of the watershed and meridian sections

An auxiliary boundary pillar

only natural that during the rains any traffic over it should completely wreck it.

The general direction of the boundary from B.P. 34 to B.P. 37 is roughly north-westerly; at the latter point it turns due north, and continues so until B.P. 39 is reached, when it turns due west. One of the mining companies holding concessions in that area helped us to reopen the road beyond Niankasa Camp to B.P. 38, and then across the B.P. 39 salient to a point on the watershed about midway between B.P. 39 and B.P. 40. This road passed within a mile or two of Caenby Farm, mentioned by Major Steel as the farm on the Lunga River owned by a Mr. Owen. Like most of the early pioneers in this part of the world Mr. Owen had come to a lonely end in the bush and had been buried just off our boundary road on the Mutoma river. Mr. Larsen, who is now the manager of Caenby, was very kind to us during our stay in those parts, supplying us when he could with fresh vegetables and fruit. Whilst working on this section of the watershed the Belgian base camp was situated on the boundary a few miles west of B.P. 39 near the site of old Sakabinda village. As their share of the road work the Belgians reopened the old track along the boundary from where our road turned westwards near B.P. 38 round the Sakabinda salient and on to a point between B.P. 40 and B.P. 41. They also opened up the old road from Sakabinda northwards to Musonoi, a station on the Lobito Bay railway then in course of construction. We carried on the reopening of the boundary road from the point where the Belgians left off. From B.P. 39 to B.P. 43, the point on the watershed immediately above the source of the Zambezi, the boundary runs in a westerly direction, but near B.P. 43 it takes a sudden turn to the north and then continues to run north and north-west until the Angola frontier is reached. Instead of taking our road across the B.P. 43 salient as the old Commission had done with their wagon road, we continued along the watershed. It was naturally some 10 to 15 miles longer than the short cut across, but not only did we want the road to be near the field parties, but by going south we took our road nearer the Boma or Government station at Mwinilunga, thereby helping the same concession company who had helped us earlier on. They had a prospect in the neighbourhood of Mwinilunga called Luamata, and the construction of a road to it branching off our boundary road was no difficult task. Tons of drilling gear were transported from Nchanga in the centre of the copper belt to Luamata by this road. Our road eventually ended up at Hillwood Farm, having left the boundary about midway between B.P. 43 and B.P. 44. Hillwood Farm is a few miles south-east of Kalene Hill Mission Station, also mentioned in Major Steel's paper. Thus our road was a distinct asset to others besides the mining people, to the Boma officials at Mwinilunga and the missionaries at Hillwood Farm and Kalene Hill.

Unfortunately, owing to the sandy nature of the soil it took some time for the road to consolidate properly, and during the whole of the time we were using it the going was always bumpy and extremely slow. The short bit of road between the boundary and Hillwood Farm crossed the Zambezi at a point about 8 miles from its source.

Transport was our biggest worry. The original commission had been able to overcome their transport difficulties by the use of traction engines and ox

wagons. The former were no longer available, for although the very same engines as had been used in 1913 were still in existence, Kansanshi Mine could not spare them, owing to the great activity in the copper belt at that time. Ox transport alone would have been far too slow for our requirements, and as the construction of bush roads suitable for mechanical transport was no difficult matter, we were able to use lorries and cars. A 6-wheeler 2-ton lorry, a 30-cwt. truck, and two touring cars, all of a well-known British make, were purchased by the British Section in 1927. When I arrived in 1930 the 6-wheeler and one touring car alone remained in addition to an American 30-cwt. lorry which had taken the place of the truck: that and the other tourer had succumbed to appalling road conditions and lack of attention. Actually I do not think any make of car or lorry could have stood up to our roads for long. The American lorry was as bad as the British, but it had extra power, which was a distinct advantage. But the chief drawback to the British vehicles was that one could not get spare parts nearer than Bulawayo; the agents there very seldom had the parts one wanted in stock, so that in the end we had to order all spares direct from England—an impossible situation. Luckily, as soon as we got clear of the Angola area and had got back to moderately good roads again I was able to have all my transport done by local contractors, thus obviating the necessity of buying new vehicles to replace the 6-wheeler and the other lorry. The second touring car gave up the ghost at the beginning of 1931, and as a replacement for both cars two Ford Vanettes were purchased from Ndola agents. These were just what we wanted, they could carry 1000 lb. and more, and having a powerful engine the chances of bogging were more remote, or rather less certain, because no vehicles short of a tank could have possibly used our roads without sticking sometimes. Spare parts from a nut to a new engine were always available at Ndola, and our transport difficulties disappeared as soon as the older vehicles had been buried.

The base camp in the neighbourhood of Caenby Farm, known as Kasoni to the Commission, from which the Angola end of the watershed boundary was completed, was about 180 miles from the railhead at Kipushi. All supplies necessary for carrying on the work during the rainy season 1930–31 had to be transported from Kipushi by road before the rains actually set in, and it was well that full provision had been made, because after a month or two of rain the road between Kansanshi and Kasoni became impassable to any kind of motor vehicle, and stores could only have reached us by carriers. We sent native cyclists into Kansanshi (120 miles each way) every week to collect our mail, and they, poor wretches, owing to the state of the road, had to cover most of the distance on their flat feet. The feeding of our native personnel was none too easy between Kasoni and the Angola border, and had we not been able to purchase native foodstuffs from Hillwood Farm our task would have been rendered much more difficult and costly. The meal issue, either mealie or other grain, was as much as 2 lb. per carrier per day, so it can be realized that vast supplies of this commodity were required to feed several hundred carriers for several months, and these supplies had to be in the right place at the right time, and to carry them there more carriers had to be employed, and they also required food—a well-nigh hopeless task in the rains, especially when one knew that a good soaking would spoil the meal. However, we got through the

job somehow, and I cannot say how relieved I was when I was able to start the move to the other end of the watershed boundary.

The demarcation of the boundary from B.P. 33 to B.P. 11 had been completed by Colonel Clough in October 1929, so that the only portion of this section left to be demarcated was that between B.P. 11 and B.P. 1 (junction with the meridian section). As soon as the traverses at the western end had been completed I sent Captain Heap and two N.C.Os. off to Bwana Mkubwa to reconnoitre, beacon, and observe a triangulation connecting Colonel Clough's last side to the arc of the 30th meridian, a distance of about 130 miles. I went with them to see them started and in order to have a look at the country and at the same time to choose a good site for a base camp. During the month previous to leaving Kasoni I had had the road to Kansanshi and the northern road to Ntenke (*via* Musonoi) in the Congo reconnoitred, and had decided to move by the latter, more especially as the Congo railway authorities had very kindly given me permission to make use of their construction trains between Musonoi and Ntenke on the link connecting the Lobito Bay railway to the C.F.K. system (Dilolo–Ntenke).

It took us three days to transport ourselves and our stores over the 75 miles between Kasoni Camp and Musonoi. Our vehicles either broke down from mechanical defects or else kept sinking up to the axles in mud. At Kolwezi, the nearest station to Musonoi, we found a special coach and goods wagon waiting in a siding for us, and all we had to do was to transfer our loads from the lorries to the wagon and then to wait patiently for an engine to take us to Ntenke.

After a wait of about thirty hours a distribution train came through from Dilolo and hitched us on; our journey to Bwana Mkubwa *via* Ntenke, Elisabethville, and Sakania, then proceeded without further difficulty, and we arrived at our destination on April 13. I would like to take this opportunity of again recording our appreciation of the numberless kindnesses accorded to the Commission by the managements of the C.F.K. and the Rhodesia Railways.

A few days were spent at Bwana Mkubwa preparing three parties for the field: two beaconing parties each under an N.C.O. and one observing party under Captain Heap. The Administration had previously been warned of our labour requirements, and had been asked to have the necessary number of carriers ready for us at Bwana Mkubwa. This had been done, so that all that was necessary was to split them up into gangs and ration them, and then hand each over to its particular party. On April 15 the beaconing parties moved off and commenced their programmes, whilst Captain Heap and I reconnoitred the country in the neighbourhood of Musofu Mission, which lies about 20 miles due east of Walamba Station. Walamba, which is nothing more than a small siding on the railway, lies about 40 miles south of Bwana, the two places being connected by a moderately good road. After the flatness of the Angola end of the watershed, with never a view worth mentioning, and hemmed in on all sides by the eternal bush, it was most refreshing to see that the country we were about to work in was cut up by rugged chains of hills and dotted here and there with solitary peaks whose heights ran up to 1000 feet above the surrounding country. A site was chosen for a base camp in the neighbourhood of Mandowesa trig. station, a point on the boundary which later became B.P. 6. A con-

tractor was put on to making good the Musofu Mission Road, and to cutting an 18-mile branch out to the camp.

This work was completed by the beginning of May, when Sergt. Burne and a party of Askari arrived at the camp which we called Mandowesa and commenced erecting the necessary stores and living huts. These were much less substantial than those erected in previous camps because I supposed that the camp would be in occupation for a few months only and that we should be clear before the heavy rains set in. As it happened we had to spend the whole of November in the camp, and the rains being heavier than usual for that time of the year we had a rather unpleasant time owing to the frailty of the huts. Large stocks of meal and other native foodstuffs were collected at Mandowesa for feeding the field parties and ready for the arrival of the rest of the British Section, who were still working at the Angola end. I returned to Kasoni Camp at the beginning of May and continued computing our catenary traverse while preparations were made for the final evacuation and move to Mandowesa. I had to be quite sure that no mistakes had been made in our survey before packing up in that area, as it would have been fatal had we found something wrong after our move of several hundred miles to Mandowesa.

We carried out our final evacuation of Kasoni and move to Mandowesa at the beginning of August. By that time Captain Heap had completed his triangulation and had closed on the side Chantuntile–Msenguli of the Rhodesian arc. Previously it had been the practice of both sections of the Commission to observe the major triangulation independently, but in this case the Belgian Section was relieved of their share in view of the fact that surveyors of the Comité Special du Katanga were already engaged on that particular task. Captain Heap kept in touch and co-operated with M. Van de Straeten, who was in charge of the C.S.K. party. Thus the Belgian Section were able to sit down at their Sakabinda Base Camp and go ahead with the drawing of their boundary plans, not moving to the other end of the watershed till towards the end of July, when our major triangulation programme had been completed and we were ready ourselves to begin our location and survey of the boundary.

The Belgians, whose base camp was situated a few miles out of Sakania on the Kabunda road, started work at B.P. 11, whilst we started at the B.P. 1 end and worked towards them. The watershed between B.P. 1 and B.P. 11 is markedly different from section B.P. 11 to B.P. 46. The country is very hilly with occasional low divides between the ranges. In some cases the range of hills is well defined and the watershed easy of location. In other parts where the hill formation is irregular there was great difficulty in locating the watershed. The low divides presented the same problems as the general run of the boundary from B.P. 11 to B.P. 46, and the same methods of locating were adopted. Although we had no difficulty in locating the watershed along the well-defined ridges, we found it a different matter when it came to surveying it and fixing it on the map by the triangulation and traverse methods I have described previously. The former was simple enough, but traversing along a boulder-strewn crest was the reverse of easy, especially when it was everlastingly changing direction and when the ups and downs were extremely violent: precipitous in some cases.

B.P. 1, the point where the watershed section joins the meridian section of

Crossing the Zambezi 8 miles from its source

Crossing the Kafue between Chambishi and Mufulira

B.P. 46: junction of the Northern Rhodesian, Belgian Congo, and Angola frontiers

A section of the meridian boundary cutting

Main boundary pillar, and trig. station from which its position was fixed

the boundary, is about half a mile to the north of the Great North Road which connects Abercorn in North-East Rhodesia with the railway at Kapiri Mposhi and at a distance of about 93 miles from that place. In October, while work was still in progress on the watershed section, I reconnoitred the country in the neighbourhood of B.P. 1, and chose a site at the head of the Lukushashi river for another base camp, from which to carry out the cutting and survey of the meridian section. Some temporary shacks were rapidly erected on the site, and all stores and equipment that were not in actual use were transported there from Mandowesa by carriers, 50 miles across country, leaving the heavy stuff to be taken by lorry transport, the distance by road being about 140 miles. The rains set in with great virulence at the beginning of November, turning the branch road between Mandowesa and the Musofu Road into a morass, so that our transport had the greatest difficulty in getting through. However, the survey of this section of the boundary was completed by the end of November before the road became quite impassable, and we were enabled to retire to Cape Town for a working recess. Sergt. Burne was left in charge of the construction of the new Lukushashi Camp to which everything had been transferred from Mandowesa by the middle of December. During the three months we spent in the Cape Peninsula we completed the triangulation and traverse computations of the last section of watershed boundary, and got well ahead with drawing our boundary plans; these were cadastral in nature and were drawn to a scale of 1/10,000. Through the kindness of Professor Snape and the authorities of Cape Town University we were given most spacious accommodation in the Civil Engineering wing of the University, where we were able to carry out the indoor part of our work under the most ideal conditions. We had already worked through one rainy season in the field, and I did not consider it wise to do a second without a change, especially as there was quite a good chance of our having a third before the whole of the job had been completed. The Belgian Section spent the recess at their Sakania Base Camp. Thoroughly refreshed, we all returned to Lukushashi Base Camp at the beginning of March 1932, and immediately started work on the meridian section of the boundary.

The definition of the boundary between lake Mweru and the Congo–Zambezi Watershed had been given originally as "the thalweg of the Luapula up to its issue from Lake Bangweolo. Thence it shall run Southwards along the Meridian of Longitude of the point where the river leaves the Lake. . . ." This definition was made at a time when no maps of the lake Bangweulu area existed, and was based on a completely inaccurate idea of its topography. The framers of the Boundary Agreement very probably imagined that the Luapula flowed out from the south-west corner of lake Bangweulu, whereas in actual fact it does not come from the lake at all but is identical with the Chambezi river which rises in the neighbourhood of Abercorn, taking the name of Luapula after flowing through the swamps to the south of lake Bangweulu. According to Major Gillam, who thoroughly examined this area in 1912, the wide channel which leaves the lake at Mpanta flows almost due south for about 15 to 20 miles, and then is lost in the swamp. In his report he stated: "During the dry season, when the mud-banks (covered with very tall papyrus and giant reed growth) of this channel begin to show, the water becomes almost stagnant. Its yellowish colour shows this, which is so noticeable after the deep clear

Main boundary pillar, and trig. station from which its position was fixed

A section of the meridian boundary cutting

B.P. 46: junction of the Northern Rhodesian, Belgian Congo, and Angola frontiers

swift-running water of the Luapula river, as it winds its way through the swamps away in the south-east."

At the outset it was agreed between the Belgians and ourselves that the longitude of B.P. 1 should be accepted as that of the meridian to be cut. This pillar, which had been constructed by the Belgian Section of the early Commission in 1914, consisted of a number of large rocks cemented together. During the survey of the watershed section it had been connected to the triangulation, hence its geographical co-ordinates were available. By mutual agreement the Belgians became responsible for the cutting of the northern half of the meridian whilst we took on the southern half, which, owing to the nature of the country was the easier half of the two. The ridges and isolated hills which characterize the watershed area between B.Ps. 1 and 11 continue up the meridian as far as Mikumbi Hill, roughly the halfway point.

Beyond Mikumbi the ground descended very slowly to the river Luombwa, beyond which it is absolutely flat and under water during the rains. So while we had no difficulty over our triangulation the Belgians had to build towers in order to carry forward the control as far as the Luapula. After leaving the hilly country the bush gets thinner and thinner and finally disappears altogether. Every variety of game abounds in the open grass plains to the south of the Luapula, and the surveyors who carried out the demarcation in that area had some quite exciting experiences. A brief description of the methods employed in demarcating and surveying the meridian are given in Appendix II. The field work of this survey was completed by the second week in July 1932, when the two sections of the Commission returned to their respective base camps at Sakania and Lukushashi to await further instructions regarding the final section of boundary between lakes Mweru and Tanganyika. Luckily we had plenty of computing and drawing to keep us occupied during the hiatus that ensued.

During the second week in October I received instructions to carry out a topographical survey of the boundary area between lakes Mweru and Tanganyika. The British and Belgian maps produced by the 1913 Boundary Commission differed considerably, each showing many features that did not appear on the other. The discrepancies were so great that any description of a natural boundary in that area based on one of the maps would have been incorrect in many places if read in conjunction with the other. It was for this reason that the fresh survey of the area was undertaken. Lukushashi Camp lies about 450 miles south of Abercorn, the provincial headquarters nearest to the proposed survey and through which I had to obtain my labour for the work. It took three weeks to collect the necessary number of carriers as well as native foodstuff sufficient for feeding them. By November 20 two trigonometrical and three topographical parties had taken the field and the Commission headquarters had been transferred to Kambole, a mission station, 54 miles northwest of Abercorn.

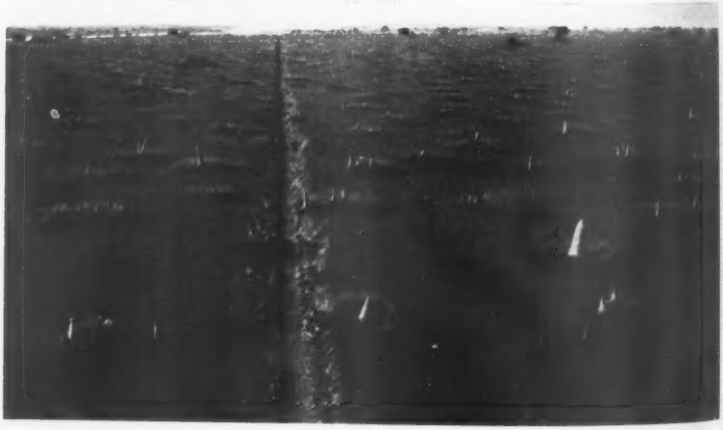
The rains were in full swing when work commenced and continued without interruption other than a short period in January, right to the middle of April 1933, by which time all field work in that area had been completed. Conditions could hardly have been worse for health and comfort, but the bad weather did not interrupt the work to any extent, and although the country was often submerged in cloud or mist, the dry hazy weather of June to October would have

Kisebwe Tower trig. station, about 50 feet high

The old and the new B.P. 41

B.P. XXVIII, marking junction of the Luapula and the Mpanta Meridian

Irumi Mountains near the eastern end of the watershed boundary



Open plains south of the Luapula (seen in the background)

made observing very much more difficult and reconnaissance impossible. From about February onwards the field parties had to contend with swollen rivers and flooded flats, whilst swarms of mosquitos and tsetse fly added to their discomfort. The country adjacent to the boundary is either swamp or mountainous and inhospitable for its entire length. We found the inhabitants, such as they were, to be more miserable and degenerate and even more starved than any we had had dealings with on the other sections of boundary. In fact our recollections of that particular area are not very pleasant. In spite of the fact that we were working through the Mweru Game Reserve we came across very little game.

In 1929 the surveyors of the Comité Special du Katanga, under M. van de Straeten, had measured a first-class base at Pweto and had extended it to connect with the 1913 boundary triangulation, remeasuring the first figure of that chain. Our task was to connect that figure to the arc of the 30th meridian, which was at that time being extended northwards through Tanganyika Territory by Major M. Hotine, R.E., and a special party. The country is extremely difficult; all the ridges, which are heavily wooded, run in an east–west direction and are of approximately the same height, with few isolated hills. The trees found in this area are on the whole bigger and tougher than those we had encountered elsewhere. Clearing the bush round stations was consequently a much more tedious affair than before, and when clearing rays ran up to three-quarters of a mile it can be understood what a job we had in locating stations. In one case only did we find it necessary to erect a tower. The parties found difficulty in improving on the general scheme of the 1913 triangulation, but they were able to strengthen the figures very considerably by the inclusion of new points.

The 1913 connection to the arc skirting the south-west corner of the lake was ruled out because it involved poorly conditioned triangles and the erection of several towers, and the nature of the country did not permit of any improvements in either respect. It was found possible however to make a connection to the arc by rays across the lake to two of Major Hotine's points, Mbaa and Mtantwa West. These rays were anything up to 70 miles in length and could be observed only with the aid of helios or lamps. Luckily Major Hotine and his party, who had the requisite equipment and who had been observing rays such as these for months past, were still in the neighbourhood, and I was permitted to enlist their services for the observation of the connecting figure.

As regards the topographical programme, owing to the heavily wooded nature of the country, plane-tabling was out of the question, and mapping had to be done by traverses. All field work between the two lakes was completed by the middle of April, and as no agreement had been arrived at between the Belgians and ourselves regarding this particular section of boundary we returned to Lukushashi Camp to finish off and pack up. By the beginning of June Lukushashi Camp had been evacuated and we had all started on our way homewards.

I cannot conclude without paying a tribute to the Europeans of both the Belgian Congo and Rhodesia, who must be among the most hospitable people on earth. We all left that part of the world with deep regrets at parting from the many friends we had made while there.

APPENDIX I: ORGANIZATION OF CATENARY TRAVERSE PARTIES

The work was organized in three parties as follows:

(1) A Setting-out Party of two N.C.Os., R.E., cleared the boundary cut where necessary, and a good deal had to be done, as the cut had been made some time before and the rains had meanwhile set in. They aligned and set out pegs at the required intervals along the traverse legs, and built the main concrete pillars at approximately 5-km. intervals.

At first digging circular ditches at the auxiliary points was also included among the tasks of this party; but we found that, owing to the sandy soil, the ditches added to the difficulties of the other parties. Consequently no further digging was done until the traversing had been completed.

(2) An Angle Party of one officer and one N.C.O. measured the traverse angles, both horizontal and vertical, and made connection with any trig. stations that were visible from the traverse. For the horizontal angles six rounds on six zeros were measured, the maximum divergence allowed being 5″.

Quite early we began to get strange results, and after a certain amount of worry we found that they were due to tripod-wobble on account of the looseness of the soil. To remedy this the tripod legs were stood on pickets driven in flush with the ground. The pickets were usually about 6 inches in diameter and from 4 to 5 feet long.

Generally speaking this party could work only between 6 and 9 a.m. and between 4 and 6.30 p.m. owing to shimmer or rain. Only on rare occasions could work be continued throughout the day. As it stood the traversing apparatus was not suitable for night work.

(3) A Taping Party of one officer and one N.C.O. measured the length of traverse legs. Each bay was measured three times, the maximum divergence allowed being 0·002 foot. Tapes were 301 feet invar, and 100 feet steel for the short distances. All measurements were made with the tapes suspended in catenary and the tapes were standardized as often as was necessary.

Teaching the carriers the traverse drill was none too easy, and it was some little time before we dared let them touch the standard invar tape. About the middle of the work we had to change over to a new gang of carriers owing to the three-months' contract of the old gang having expired. But this gang gave us no trouble, we simply double banked the two gangs for a couple of days, and though there was a certain amount of pandemonium the new crowd soon picked up their various jobs. Our output gradually increased from next to nothing at the end of October to between $1\frac{1}{2}$ and $1\frac{3}{4}$ miles a day; the most we succeeded in doing in one day was just over 2 miles. The output of the Angle Party was practically the same as that of the Taping Party; if anything, a little less.

Astronomical Azimuths

Owing to the weather it was not possible to take any astronomical observations along the boundary until April 1931, when the traversing had been completed. One officer and one N.C.O. then worked back along the traverse from B.P. 46, observing azimuths at roughly every other main boundary pillar.

APPENDIX II: METHODS EMPLOYED IN CUTTING THE MPANTA MERIDIAN

Four parties were employed on the work, as follows:

Party A, one officer, was responsible for the Major Triangulation.
Party B, one officer, was responsible for the Minor Triangulation.

Party C, two N.C.Os., located the Meridian.
Party D, two N.C.Os., cleared and traversed the line set out by Party C.

The officer B worked well ahead of parties C and D. Starting from B.P. 1 he marched straight up the meridian by compass and at intervals of approximately 5 kilometres he selected points as near the meridian as possible, which required the minimum of clearing to open them up to at least two major trig. points. Normally from each of these boundary stations three or more major points were visible, which enabled B to resect his position on a plane-table, and showed him where he was with reference to the meridian. Having erected the usual type of signal, he next proceeded to observe horizontals and verticals to all the major points that were visible. From these observations he computed the position of the new point. When he had completed his work at each station he passed to Party C the geographical co-ordinates of the station, and the azimuth to one of the outside major points.

Party C having been given an azimuth at B.P. 1 to one of the major points started lining our pegs up the meridian from B.P. 1 by theodolite, the bush being cleared. The party continued to line out pegs until they arrived at the first signal erected by B. The distance from the station to the cutting in an east-west direction was then measured and checked against the value derived from the geographical co-ordinates of the station as supplied by B. Then, provided there was no great discrepancy between these two values, party C continued to line out pegs up the meridian, deducing the direction from the azimuth given by B.

Party D started off by clearing the 5-metres lane and hoeing a path, 1 metre wide, along the line as set out by party C; then, while this work was proceeding under the supervision of Askari, they started traversing from B.P. 1 northwards, by methods similar to those of the watershed boundary traverse. The party was also responsible for inserting pipes and marks at each of their traverse stations which eventually became boundary pillars. As the traverse proceeded party D sent their field books back to the base camp, where the traverse was roughly computed as a check on the work. The final computations could not be put in hand until after the completion of the triangulation.

When B had completed his work on the meridian to the halfway point (B.P. XVI) and had joined up with the Belgian cutting, he moved out to the major points and completed his minor programme.

When party C had finished their set-out to the halfway point, one N.C.O. joined party D to help with clearing the boundary cut, while the other returned to the base camp.

When party D had reached B.P. XVI with their clearing and traversing, party C reformed and started building the boundary pillars between B.P. 1 and B.P. XVI, while party D continued to traverse the Belgian cut from B.P. XVI northwards.

Diary of the work

1. Work on Meridian started	March 16	1932
2. Major Triangulation programme started ..	March 29	
3. Major Triangulation programme finished ..	April 27	
4. B completed Meridian Triangulation ..	April 30	
5. Party C completed set-out to B.P. XVI ..	May 6	
6. B finished minor trig. programme	May 10	
7. Party D finished traverse to B.P. XVI ..	May 24	

The distance between B.P. 1 and B.P. XVI was approximately 75 kilometres.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The paper to-night, as you have seen, is on the Rhodesia-Belgian Congo Boundary, a joint boundary between ourselves and the Belgian Congo. Colonel Peake, the Chief British Commissioner, who is going to address us, has been surveying there for the last three and a half years. It is a very interesting and now a very important piece of country on account of the mineral wealth that exists on both sides of the boundary. That of course makes it very necessary to have a precise and agreed boundary.

Colonel Peake is a thoroughly experienced surveyor. Since the war he has been engaged entirely on survey work: five years in the Gold Coast; since that at Malta, and on other smaller pieces of work; and now for three and a half years in the region of which he is going to speak to us to-night. I now ask Colonel Peake to give his paper.

Colonel Peake then read the paper printed above, and a discussion followed.

The PRESIDENT: We are honoured to-night by the presence of H.E. the Belgian Ambassador, Baron de Cartier de Marchienne, and we shall be pleased if he will kindly address us.

H.E. The BELGIAN AMBASSADOR: It is very gratifying to be allowed to say a few words on this occasion, and, first, I should like to thank Colonel Peake for the most interesting lecture he has just given us. I have not been to the Congo, but after having seen what has been shown on the screen I am going right away! There are many reasons for visiting that part of the world. First, one would like to speculate as to whether some kind of use could be made of those enormous anthills. Also, as a result of what the lecturer said with regard to motor transportation, one imagines that it would be very good for those who suffer from liver complaints. I have a very bad liver and I think I will go and investigate conditions in that part of the world instead of going to Harrogate to take the baths.

Colonel Peake's remarks about the cordial relations existing between my compatriots and yours have given me great satisfaction because I realize that once again, as always, Britons and Belgians have got along very well together. The British and Belgian officials in the Congo always work in harmony.

I am glad of this occasion to say how happy I am to know that Sir Philip Cunliffe-Lister, who is ill in Nairobi, is getting on well, and we hope he may soon be back in England in his usual good health. I understand that H.R.H. Prince George to-day arrives in South Africa, and I hope he will make a thorough survey, not only of South Africa, but of Northern Rhodesia, and that he will pass through the Congo and, possibly, stay there two or three days to see for himself what we have done there. Your princes, naturally, take a great interest in all colonial matters. So do the Belgian princes. Quite recently H.R.H. the Duke of Brabant came to London at the invitation of the African Society and gave a most interesting lecture on the protection of the flora and fauna, not only in Africa but the world over. I think everybody who listened to the address will accept my view that it was one of the most interesting they had heard for a long time.

Once again I thank you, Mr. President, for having given me this opportunity of saying a few words.

The PRESIDENT: Colonel Crosthwait, as you know, has done a good deal of boundary survey, though not in Africa. Nevertheless I am sure he will have some interesting observations to make.

Colonel H. L. CROSTHWAIT: I am afraid my title to speak is a very slender one.

To begin with, I have not been to the Congo or to Northern Rhodesia. My only connection with the country is that I happen to be concerned with the Aircraft Operating Company that surveyed a portion of the Rhodesia–Belgian Congo boundary, but it was done before Colonel Peake went out—in the time of the former British Commissioner. They asked us to survey from the air a part of the boundary which passed along the watershed which was very ill defined. It was thought that with overlapping photographs and the use of a stereoscope it would be possible to identify the watershed which the boundary follows. I believe that was fairly successful; at any rate, the Commissioner of that time, Colonel Cree, reported very favourably on the photographs.

One of the great difficulties that the Boundary Commissioner has to contend with is the imperfect definition which is often given in treaties regarding boundaries which have to be settled. In another boundary with which I was connected the definition of the boundary was that it should follow the continental water-divide, which was the highest peaks of the Andes. This was the Chile–Argentine boundary. Well, the watershed did follow the highest peaks of the Andes for a long distance, but there were places where it descended into pampa and was extremely indefinite; in fact so indefinite that one could, by digging a trench a few feet deep, alter the flow of water, either to the Atlantic or to the Pacific. That caused a great deal of heart-burning in cases where it was necessary to cut up somebody's farm and hand him over either to Chile or the Argentine, in neither of which he wanted to be. So, as I say, many of the Boundary Commissioner's difficulties arise from lack of clear definition; and that arises from the fact that those who make the definitions have no knowledge of the country. They assume that a watershed follows a certain line, whereas when you come to examine the ground you find it does not.

I suggest to Colonel Peake that it would be an advantage if all international boundaries were photographed from the air. The photographs could then be attached to the protocol, as the map is, and could be used if any dispute arose in the future: if a boundary pillar had been removed, or something of that kind. The cuttings through the jungle, which he showed on the screen, get grown over, but, as a matter of fact, if the boundary is photographed from the air the original cutting will show up, as we know from the old archaeological remains, ancient roads and agricultural markings, which come out clearly in photographs, though they are impossible to trace when one is on the ground.

Colonel MACLEOD: I do not think I can add very much to what Colonel Crosthwait has said. In the course of my duties I see a good deal of the work of Boundary Commissions. Every one of them illustrates the points that Colonel Crosthwait has mentioned. Nearly all of them have been delayed and the work made difficult by what I can really only call mistakes on the part of the original negotiators who, in their desire to make themselves especially clear, are very often tempted into a redundant definition. They sometimes say, for example, that the boundary runs "along a certain river to its source," and try to be extra clear by adding "on a certain mountain." When the Commissioners arrive on the spot they find that the river does not rise in that particular mountain, and of course the demarcation has to come to a halt until the question is referred back to the respective Governments to ascertain what those who defined the boundary really meant. Such lack of precision causes great delay.

With regard to air photographs I may say they have been used already on one Boundary Commission, namely between British and Italian Somaliland, and are actually now being used on another which is in progress, demarcating the boundary between British Somaliland and Abyssinia. The photographs have been taken by the Royal Air Force and have proved most useful. In this case

there is an R.A.F. station at Aden, more or less on the spot. Undoubtedly the use of air photography has expedited the work very much indeed, and I think, as Colonel Crosthwait suggested, it is quite possible that air photographs may also be very useful for future reference.

What Colonel Peake has told us has brought out, in a way that everybody appreciates, what a great deal there is in boundary demarcation. To the layman laying out a boundary may sound rather a simple business, but obviously the Boundary Commissioner has plenty to think about.

The PRESIDENT: As no one else wishes to speak it remains for me to close the meeting. I think you will agree, from what we have seen of this particular piece of boundary work, that it is a most extraordinarily difficult boundary to deal with, especially a boundary which shall be permanent in country of the character which we have seen on the screen. As the lecturer told us, part of the country was surveyed before the war, but with the lapse of a few years the marks became practically non-existent, and that in spite of the fact that those responsible for such work go to tremendous labour in order to erect boundary marks that can be seen. Though those great masonry boundary pillars will no doubt remain, nevertheless, if the ground is neglected for a few years, the pillars will inevitably be surrounded and covered by bush. So that I am very strongly of opinion that no such boundary could be expected to remain unless there were some regular organization for keeping it up and inspecting it periodically. I should like to ask Colonel Peake if any such arrangement has been come to?

Colonel PEAKE: Yes, it is already arranged for. In the Protocol signed by the Belgians and ourselves it is laid down which of the sections are to be kept up by the Belgians and which by ourselves. About every ten years there will be a joint Commission detailed to perambulate the entire watershed; otherwise each country will be responsible for its own particular section.

The PRESIDENT: Thank you. Once again, ladies and gentlemen, before I conclude, I would like you to remark, as no doubt you have done, what delightful terms the two Commissions have been on. They were both ever ready to co-operate and help one another out of difficulties. It is a great pleasure, I am sure, to H.E. the Belgian Ambassador, as it is to us, to know that relations were so cordial. I will not detain you any longer except to ask you to join me in thanking Colonel Peake heartily for his very valuable paper.

IN SEARCH OF ZERZURA

LIEUTENANT ORDE WINGATE, R.A.

IN an age whose mechanical invention has dwarfed the dimensions of the Earth and will soon leave no corner unsurveyed, no obstacle unsurmounted, the conditions that afford the type of adventure pursued by the geographical explorer grow increasingly hard to find. The explorer of to-day is the man with a muck-rake in his hand. His dreams are of microscopic discoveries that have escaped the telescopic vision of the early travellers. He needs other qualities than those that brought success to the latter. He need have little love of danger, hardness, or solitude. Instead of throwing his imagination across a range of mountains, a waste of sand or of waters, of which nothing is certainly known, he must concentrate it on a prescribed area about which little remains unknown.

Five years of marching in the Sudan had qualified me to undertake the old type of exploration. The scientific qualifications required for the new type I did not possess. I had therefore to seek an area comparatively unexplored, and, as far as possible, impassable to mechanical transport, in the manipulation of which I was not more expert than others, and the expense of which I could not afford. The sand sea of Libya fulfilled to some extent these conditions. Until 1929 it was held to be impassable to cars. Since then Bagnold has twice crossed it from north to south, the direction of the lines of dunes; while Clayton, of the Desert Surveys, has crossed it from east to west. At the moment of writing the invention of a new type of tyre is claimed to have made possible the surmounting of sand-dunes in any direction, and the sand sea, save for one small area of chaotic dunes, has become as open to cars as the ocean to ships. There are however certain advantages in travelling on foot of which the motorist is deprived. The pedestrian is unhurried. He can stop to investigate anything of interest without upsetting his programme; and he is likely to notice detail that will escape the traveller at speed, a matter of some importance in a waste whose utter emptiness makes the minutiae of nature of more interest than the general geographical features.

So empty and void of interest is the sea of sand that even the most enthusiastic of explorers would hesitate to venture himself among its heartless dunes, but for two legends, still to be verified, that lend to it a romantic interest. The first is the story of Cambyses, of whom Herodotus relates that in the year 525 B.C., being rewarded with madness for the killing of the Apis, he set out to the conquest of Nubia. And, on the way, hearing of the riches in the temple of Jupiter Ammon at Siwa, he detached an army of 50,000 Persians to march there by way of the Great Oasis. This they reached and presently set out across the sands to go to Siwa, led by Egyptian guides. After three days a sandstorm arose and annihilated them. Somewhere in the sand sea their bones, swords, and armour await the arrival of the man who is destined to recall to a softer generation the memory of their heroic failure. The second is the legend of Zerzura, the oasis of fluttering birds, or of the blacks, the only one of a number of oases referred to in old manuscripts and travellers' tales that has not been identified. The chances of finding either are so small that

no one who did not love exploration for its own sake would ever trouble his head about them. For me the sand sea had the further advantage of lying almost entirely within Egyptian territory, thus obviating the political obstacles to travel in other countries; I could employ camel transport, to which I was accustomed, and I spoke the language.

Having chosen the area of operations I had to select a definite itinerary, arrange transport, equipment, and personnel, obtain and master the use of certain surveying instruments, acquire such smattering of geological and archaeological learning as would enable me to observe and record points of interest coming under these headings, apply for leave, and, most difficult of all, keep the total expenditure within the limits of my means. In the achievement of these ends I met with much help and encouragement from various sources. The Royal Geographical Society not only engaged to supply me with surveying instruments but sent them to me, at my request, several months before I was due to start; in order that I might find an opportunity of learning their use when on the march on the Abyssinian frontier.

An account of the preparation for an enterprise possesses little interest for the general public, but, for the few who are hoping to attempt something similar, the preparation is of more importance than the execution. For this reason I propose to devote some space to a description of the difficulties I encountered and how I surmounted them.

To begin with there was the question of transport. I had decided that this was to be by camels. The advantages of camel over motor transport appear at first sight to be negligible, and undoubtedly the two methods are not comparable from a commercial standpoint. Cars are faster, require less attention, can be procured to specification, relieve the traveller of nine-tenths of the tedium and heartbreak of the journey, multiply his radius of action by five or six times, and make possible a far greater measure of personal supervision with its corollary of self-reliance. Against all these advantages, the personal preference of the individual traveller for camels will have little weight with those who do not share it. There remains therefore one single advantage to be weighed. At first sight it appears pure disadvantage, and it is only experience that can teach its value. Whether this is enough to outweigh the rest depends wholly on the nature of the enterprise and the character of the adventurer. This single advantage lies in the slower and more leisurely rate of progress of the camel when compared with the car.

If the object be purely to cross a waste, then the slowness of the camel is simply a disadvantage. The only exception is when the waste is one of sand-dunes lying at right angles to the line of march; but with the adoption of 12-inch and even larger diameter tyres it is doubtful whether this still holds good. But if the object is to search for something in the wilderness, and, stunts apart, this will generally be the case in serious enterprises, the question must be reviewed in the light of the conditions, and the verdict may well be given in favour of camel transport.

Take, for example, the search for artefacts in the Libyan desert. A man in a car will never see an artefact while driving, which means that he must stop and get out to look. He will not do this if "making his point" for the day, and, in any case, can only do so at long intervals and in what he considers likely

places. As his views on the latter point are far more likely to be wrong than right, his chances of finding a fair proportion of the artefacts he drives over are small in the extreme. It is true that Bagnold's well-equipped expeditions succeeded in finding large numbers of these artefacts; but almost entirely, I think, where they are most easy to find—off the great sand sheets and south of the 27th parallel. The occasional artefact that occurs in the sands of the northern desert would be missed by the occupant of a car because there is nothing to betray its presence and it is itself very inconspicuous. Yet it has a far greater interest. Again, such points as probable sites for artefacts and the occurrence and cause of soft patches in sand will be more adequately examined by the man who travels slowly, and on foot, than by the man whose contacts with the surface he is investigating occur at 20-mile intervals. A further point in favour of camels is the sense of unlimited leisure which they impart to the undertaking. No schedule need be adhered to, no time-table observed. Distances are measured in days instead of in miles; and the effect of all this on the mind of the traveller is to make him less hurried and more deliberate. As he trudges slowly through the sand his mind chews the cud of his observations, untroubled by the adventurous progress of the internal combustion engine.

Camels vary enormously in capacity, and what is true of one breed will not be so for another. For example, whereas Bertram Thomas and Philby appear to have relied entirely on sporadic grazing for the support of their animals, which were the property of the Arabs who accompanied them, the camels which for centuries have been used to cross the pastureless wastes of the sand sea are accustomed to carry their food on their backs. The disadvantages of the method employed by the explorers of the Rub' al Khali is sufficiently illustrated by their experiences. They were both to some extent, Philby to a very large extent, at the mercy of Arab tribesmen, owners of their camels, men whose sole motive was avarice, who were unaccustomed to obey any one, and for whom the strongest argument against an enterprise was its danger. Both seem to have regarded guides as a necessity: the reason for this being possibly their desire to visit places such as Wabar, known to them and to the world only by repute. In an expedition of the Bagnold type a guide would merely prove an encumbrance. Philby's transport seems to have consisted of *nagas*, which were constantly incommoded by the pangs of parturition. Their milk formed a staple portion of his diet. Their performance under these conditions is remarkable. He seems to have regarded 20 to 30 miles a day as a good average for his baggage animals, while the riding camels could cover over 50 miles. These figures are not very different from those obtaining in the Sudan and elsewhere. A laden camel will march at 2 miles an hour for twelve hours a day indefinitely. Any attempt to hustle it leads to disaster.

For travel in the Northern Libyan Desert two types of camel are available: the Maghrabi, and the Egyptian hill camel. The latter is a poor substitute for the former, with which the Senussi were formerly wont to make their astonishing journeys, but which will generally prove unobtainable for the chance traveller. It is impossible to buy a camel to-day and embark on a journey to-morrow. A long period of training must precede effort, and months will generally be required to collect and harden the animals if the best results are to be obtained.

The Senussi Maghrabi is credibly reported to be capable of 30 miles a day over bad going, up to an easy maximum of fifteen days without water or grazing, in cold weather. Naturally some kind of forage has to be carried, and the Senussi use dates and a small quantity of *tibn*, or chopped straw. This performance is, so far as I am aware, unequalled by that of any other known breed of camel. With the extermination of the Senussi the breed of camel used by them for their desert journeys has nearly ceased to exist, and I found it impossible to obtain one, even with months of notice.

The Egyptian hill camel, with which my contractor provided me, is a small wiry animal used for porterage between the western oases and the Nile. When loaded, ten waterless days at 20 miles a day would appear to be an easy limit of endurance, after suitable training. A caravan of these animals would thus be quite capable of the journey from Bir Mungar to Kufra, if a few gallons of water were carried for a partial relief of thirst. But, were I to undertake a journey in these sands again, I would secure the Maghrabi breed or none at all. With them my radius of action would be doubled, my security trebled.

Desert breeds of camel will not carry loads of much over 250 lb. without taxing their strength. I think that wherever camels are used it will be found that their owners prefer to march by night and rest by day. The march is usually divided into two *shids* or periods; the first from about one hour before sunset to perhaps three hours after; the second from some four hours before dawn to one hour after. When grazing is available this programme should be modified to allow the animals to feed at sunset and sunrise. In this connection it is interesting to note the difficulty experienced by Philby in inducing his Arabs to march by day instead of by night, in order that he might see the country traversed.

The reason for this predilection is sound, as one would expect, being due simply to the bad effects of the sun by day. But in cold weather this is less applicable, and marching by day is attended with little risk. I did nine-tenths of my marching by day, and I did not unsaddle from dawn to dusk; a procedure which would scandalize the military expert of the camel corps. But nearly all such rules depend for their validity on the condition of the animal. Once get your beasts thoroughly hardened and you can ride roughshod over most of them. Government beasts are necessarily fat and scarcely ever hard, and must be treated accordingly.

The question of pack-saddles caused me some solicitude, which the event proved superfluous, as the *baladi* (native) saddles provided by the contractor—rude structures of wood and straw—proved perfectly adequate. The desiderata for pack-saddles, whether for camels or other animals, are three in number, and, generally speaking, are much better met by the *baladi* than by the Government variety.

They are as follows: (1) the weight must be borne by those portions of the body most capable of sustaining it, *i.e.* kept off hump, withers, and the ends of the ribs. (2) The bearing surface cannot be too big after the first requirement has been met. (3) The bearing surface must be ventilated if swellings are to be avoided. It is in this last respect that Government pack-saddles fail so lamentably. The heavy, hair-stuffed bids allow of no ventilation of the bearing surface, except through chance shifting of the whole saddle. The straw pads

employed by the Arabs, on the other hand, ensure the continual access of air to the surface under pressure, and swellings with them are invariably due to carelessness on the part of the Arab in allowing the wooden structure to bear down on the back.

In the matter of forage, the only rule is to feed whatever the animals are accustomed to eat. Naturally, in the absence of grazing they must be accustomed to a grain ration by a period of training. Camels will eat a surprising variety of food, but care must be exercised in the desert to see that they do not eat what will cause thirst. Philby quotes an example of this on p. 117 of his book. His camels had eaten freely of a saline herb with the result that they were already thirsty thirty-six hours after watering—five days of endurance of thirst thrown away in a single meal.

To conclude these remarks on camel transport I will describe the ideal method of obtaining and training it; an ideal that should not be impossible of achievement to any one who has the necessary time to devote to it. Having selected the area in which you propose to travel, find out the local breed with the highest reputation for endurance. Do not expect looks. The best desert camel is a miserable creature, spare and lightly built. Purchase as many animals as you require and hire men of the tribe that breeds them to look after them for you. Put them through a programme of training for perhaps a month, with a view to developing their endurance, and you will then have an instrument on which you can rely and whose capacity is perfectly known to you.

I would recommend that the caravan should be as small as possible. Numbers only multiply disasters and lessen your own authority. They are supposed, in desert Arabia, to constitute safety, but, to judge from the accounts of Philby and Thomas, the numbers in whose caravans, although large, were insufficient to secure them from attack, whilst far too large for efficiency or control, this belief, so far as the European is concerned, is ill considered. If attack were to be made by a large body of marauders I should personally feel quite confident of repulsing it with four ·303 rifles and ample ammunition, all under my personal command; whilst I should fear defeat with no better weapon than a mob of excitable Arabs, armed with inferior rifles which they were unable to use. The desert affords an unrivalled field for the use of the accurate long-range weapon in the hands of those who can use it. Further, the Arab raider does not expect to be killed, a misfortune he will do much to avoid.

Having failed to obtain Maghrabi camels, and being forced to rely entirely on my contractor, I was fain to make the best of the Egyptian hill camels he provided. I grew to respect their powers of endurance, although their leisurely and complaining progress was an unfailing source of irritation to me.

Having made the best arrangement for transport possible under the circumstances, I could devote all my energies to the collection of the necessary equipment, and to qualifying myself to carry out the indispensable work of surveying my route and noting points of obvious geological and archaeological interest.

From the Royal Geographical Society I had obtained a 6-inch transit theodolite, a Watkins mountain aneroid, a half-chronometer, a plane table, etc. Later I added to these a larger aneroid to detect smaller differences in

height, a couple of prismatic compasses, and a wheel with two revometers. These were lent me by the Survey Department. I had had no experience of the theodolite, and was faced with the necessity of teaching myself with the aid of Close's text-book of topographical surveying, the Nautical Almanac, and Shortrede's Tables, to make astronomical observations and to use trigonometrical formulae. I carried my instruments with me on a number of marches I made on the Abyssinian border in November and December 1932, and I succeeded in learning enough for my purpose. By January I could find local mean time, set the theodolite in azimuth, and find latitude by three methods. Mr. Grabham, the Sudan Government geologist, provided me with a simple primer on geology and with a box of specimens that were of great use in informing my mind, completely blank hitherto on this subject. I also read Kroeber's 'Anthropology,' and 'Notes and Queries on Anthropology.' These gave me some idea of what to look for in the way of stone artefacts, etc., and of the most likely places in which to find them.

There remained the questions of food and drink, of personal equipment, of comforts, and of clothing. As the first two of these considerations, and consequently the number of camels required, were dependent on my itinerary, I had to decide upon the latter as soon as possible. At that time the portion of the sand sea that had not been searched for Zerzura was roughly bounded by latitudes 24° 30′–27° 30′, longitudes 26°–25°. The area that I finally decided to search was bounded by latitudes 26°–27°, longitudes 26°–25°. My base would be Bir Abu Mungar, and as my proposed march would lie entirely outside the neighbourhood of oases, it was necessary to form a dump of grain and water at some suitable point on the line of march to act as an advanced base. This would be maintained by a second party of men and camels working between Mungar and the dump. I determined to form the latter at a distance of four days' march due west of Mungar, to march from there on a bearing of 315° for two days, turn south for one day, and so back to the dump by a detour, arriving there on the eighth day after leaving it. The replenishing party would arrive on the same day, and, after watering and resting, I proposed to repeat the previous march on a bearing of 225°, turning north after two days, and so home. Having made the necessary calculations, I was able to fix the number of camels at thirteen, with four Arabs to tend them. I further estimated the period during which I should be absent from Dakhla at forty days. I decided against riding camels because I could not supervise their training. Baggage camels of suitable type are more easily obtained and their condition does not matter to the same extent. Also there was the question of expense to be considered.

On casting up an account of all probable expenses incurred on the above counts I found that I had left very little from which to provide my own food and equipment. I had allowed myself one camel to carry my boxes of instruments, clothes, food, and bedding. Thus, out of a total load of 250 lb. I could allow 80 lb. for food, and 20 lb. for bedding and clothing. I did not, of course, take a bed, table, or chair, and I decided to dispense altogether with cooking. My staple diet was to be dates, biscuit, and cod-liver oil. I added to these essentials 1 lb. of chocolate, 10 lb. of raisins, two ½-lb. tins of grapefruit, and a tin containing nearly 10 lb. of wholemeal flour.

30 miles north-west of Regenfeld

Camp 70 miles south of Bir Mungar

"Seif" in a sandstorm: sand in foreground carried clear of the ground by wind

Preparing for the start from Bir Mungar

Bir Mungar: the well is beneath the date palm

Hard limestone country 20 miles west of Bir Mungar

For clothing I decided to wear the Arab *gibbah*, or shirt, the *immat*, or turban, over bush shirt and shorts. My legs were bare, my feet in sandals of a type similar to those used by members of Bagnold's last expedition in 1932, a specimen of which I obtained from Prendergast in Khartoum and had copied locally. There are two main considerations affecting the choice of clothing for use in the sand sea; protection from the sun and protection from the cold. The first was obtained by the means I employed, but the second was very inadequately provided, and cold proved to be one of my principal hardships.

On 21 January 1933 I left my station in the Sudan for Khartoum, where I proposed to spend a few days in final preparations and in drawing up a surveying programme, with the help of the Sudan Government Survey Department. This help was very kindly given and my instruments were adjusted and put in order. Here I bought my 80 lb. of food, my sandals and clothing, and on January 28 I left Khartoum for Egypt, taking with me everything I needed for my journey, barring men, camels, and grain. I would meet them at Dakhlat, as arranged.

Late at night on February 1 I descended from the Cairo express at Oasis Junction, and, embarking on the motor trolley I found awaiting me, went straight to the village of Qara, where I spent the night in the Resthouse. Early next morning we set out for Kharga by the desert line that scales the broken limestone scarp of the plateau dividing the oases's depressions from the Nile valley. It was my first acquaintance with the western desert, but I was less impressed by its vast solitudes than I would have been had my mind been less occupied with speculations as to when the trolley would jump the rails. The driver, with characteristic Egyptian nonchalance, appeared to be guided by one principle only. This was to go as fast as the engine and gradient would permit at any given moment. The speed we acquired when descending the more violent slopes would have qualified us to enter for the Schneider Cup. On the whole however he displayed great skill at cornering, and a catastrophe was averted. Out of the corner of my petrified eye I got my first glimpse of dunes, but my imagination was not free to dwell on the spectacle they presented. In due course the palms and *berseem* of Kharga emerged from the depths ahead, presently we were passing a Roman temple, and, a little later, were pulling up at the platform of Kharga station, where a very courteous Governor, Mohammed Bey Wasfi, was waiting to greet me. He carried me off to his house for an excellent lunch and made me very welcome.

I arranged to transfer myself and baggage to Dakhlat that night, hiring a Ford tourer and lorry for the purpose at the modest charge of £7, and at 2 p.m. we set out. Traces of the British wartime occupation are still numerous on the road to Dakhlat, which is marked chiefly by car tracks in the sand. My owner-driver, Ahmed Hamed, was full of his war experiences, and the time passed pleasantly until we reached Bilat, a village of Dakhlat, whose Omda was known to be good for a cup of tea. It is customary in these oases, when approaching human habitations in a car, to depress the button of the electric horn and to keep it depressed until the entire population is assembled to greet you, and to answer any inquiries you may wish to make. It struck me at first as discourteous, but I found that this was merely the prejudice of ignorance, and that the kindly peasantry would be hurt by any omission of the popular

Hard limestone country 20 miles west of Bir Mungar *Bir Mungar: the well is beneath the date palm* *Preparing for the start from Bir Mungar*

practice. There is real enchantment in the appearance of these huddled villages of mud brick. They are all, or nearly all, built on mounds formed, no doubt, of the remains of past villages, and they have a castellated effect that suggests knights in armour. In the dusk standards of size are somehow annihilated, and one receives the impression of a gigantic and labyrinthine castle standing on a hill, surrounded by Brobdignagian date palms and pleasant gardens with running brooks.

The Omda's resthouse for travellers was vigorously painted in reds, ochres, and greens. It abounded in cushions and couches and proved a very comfortable place for rest and refreshment. We spent that night at Mut, and early next morning we started for Qasr, where we had news of my camels. After a pleasant drive through the cultivation we drew up outside the mud walls of the township and alighted. A considerable group of notables was waiting to receive us, among whom I found my contractor, Mansour el Ghamia, commonly called Mansour Bey, a tall talkative man with mobile aquiline features, a sort of cross between James More and Guy Fawkes.

The Omda led us through the crooked, overbuilt lanes of the town to the guesthouse, where we had coffee and oranges. The oranges of Dakhlat will one day be famous. When fresh they have a fragrance that must be experienced to be appreciated. I bought a hundred of them on the spot for two shillings, and thought them worth that apiece.

Being impatient to see my camels and camelmen I insisted on going down to them at once; instead of waiting until the morrow, as strongly urged by all present. I found them collected on the sand under the north wall of Qasr, disconsolately chewing some ends of straw. The success of my journey depended almost entirely on these creatures, and I viewed them with misgiving. Judged by Sudan standards they were wretchedly small and weak. But I knew enough of camels to know that I knew nothing, and accepted with reservations Mansour's assurances that they were the very type I wanted for the sand sea.

Here, too, I met for the first time my comrades for the next five weeks. I scanned their features with interest, but without much acumen, as the upshot was to prove. They were four in number. The first to be introduced was Es Senussi Abdullah, a thick-set, sturdy Zuweia of Kufra. He had owned slaves and oliveyards in that remote refuge of the Senussi, until the advance of the Italians had forced him to abandon his patrimony and fly, with what movables he possessed, to Egypt. Twenty times he had made the journey from Kufra to Bir Mungar, ten times from Siwa to Kufra, and he knew all the Arab desert lore. His square and open face had character and courage, and in him, I felt, I should have some one on whom I could rely. The second to shake hands with me was Abd Er Rahman Saleh, a nephew of Mansour, and who was intended, I was informed, to perform the offices of friend and confidant. He seemed a sturdy honest sort of a man, and I felt I should like him. Abu Bekr Guweia, the third to be introduced, was a lean lanky figure of a man, with a rather feline expression. I concluded that he would prove a source of trouble and anxiety. The fourth was a mere boy, one Suleiman Foula, a near relation of the Abu Bekr, with a craving for cigarettes. He appeared to me to be a poor specimen and not at all suitable for the occasion.

Altogether my heart rather failed me on this first inspection of the material with which my journey was to be made. I had however no alternative but to accept it as it stood or to abandon my plans altogether. After a midday meal of chicken and oranges at the Omda's we began our final preparations for the march. I put on the clothes I was to wear for the ensuing five weeks and arranged the distribution of the loads. There was the usual disputation and confusion, without which nothing can be accomplished, and at five in the afternoon we got to our feet, took a last look at Qasr, and climbed the first dune of the many that separated us from our objective.

I was prepared for delays on this occasion but they exceeded even my most despondent estimate. Everything fell off, and while it was being tied on, the waiting camels would wander towards anything that looked edible, and minutes would be lost in collecting them again. Not wishing to lose my temper, I walked on with Es Senussi. He told me that he did not think much of the camels, that only himself and possibly Abu Bekr knew anything about the desert, and added that, in his opinion, the forage we were taking was insufficient. This was a sore point. I had stipulated for seven *ardebs* to be sent ahead to Bir Mungar, but it had not been done. Mansour had explained that it was unnecessary as we had enough with us to last for forty days. As he had not even weighed it I had little faith in his opinion, and I ordered Suleiman to run back to Qasr to fetch him. In due course he arrived in a Ford car, just as we topped the last dune before Sheikh Maihub. He announced that he supposed I had sent for him in order to make him a handsome present in token of my satisfaction, and was proportionately depressed to hear that he had to send seven *ardebs* of grain to Mungar at once as per contract.

At Sheikh Maihub (Sheikh Ibrahim on the maps) we stopped for the night and camped on a strip of clean sand, beside some tamarisk scrub. I had my boxes unloaded beside me and applied myself to the task of making a bed and preparing a meal. Unaccustomed as I was to the work, it was a full hour before I was able to lie down on my blankets under the stars and begin the arduous process of eating my way through a handful of dried dates, as hard as cardboard. A few biscuits and an orange completed the meal, and I was presently uncomfortably asleep. At two in the morning I woke up. It was bitterly cold, and my exposed side was stiff and aching. Reaching for the thermometer I found it to read 33° F. Foolishly, I had brought only three blankets, of which one was underneath me, and after huddling on every article of clothing I possessed, including towels, I was still cold and unable to sleep. Dawn put an end to my discomfort, and when the red disc of the sun had just cleared the dune to the east I was more than ready for the march. After the inevitable delays, we set out for Gebel Edmonstone.

This first stage of our journey was useful for testing my instruments. The route was marked on the map and I was able to check my computations. I had brought with me a bicycle wheel for measuring the distance marched. Something of the kind was necessary because, in the absence of wireless time signals, I could only get reliable latitudes from my theodolite. My means would not run to a wireless set. So for longitude I was dependent on the accuracy of my estimate of distance covered. Camel pace is irregular and

difficult to gauge. In marching the odd 100 miles from Qasr to Bir Nungar I had an excellent opportunity of obtaining a good value for my wheel. This value I was later able to check, thanks to meeting one of Clayton's fixed points, and found it unexpectedly accurate. It gave an error of only $2\frac{1}{2}$ miles over a march of 130 miles. By the offer of a small reward I had induced an Arab to undertake the pushing of this wheel, but I soon observed that his methods were not reassuring. When he was not zigzagging like a snake he would be running off the track to head off a stray camel, or to collect firewood. I decided to take the wheel myself and kept it until we returned to Qasr five weeks later. I soon grew accustomed to it, and for weeks after I had sent it back to the Sudan I used to feel as if I were improperly dressed when I went for a walk without it.

On that first day of marching we moved with impressive deliberation. The going was a sort of dry sludge of fine sand and black stones. A few miles to our right stretched the broken cliffs of the limestone plateau that lies north-west of Dakhlat. Our movement with relation to this feature was imperceptible. Gebel Edmonstone took up a position shortly to our rear and obstinately refused to retire into the distance. The whole landscape gave an impression of decay. Everything was falling to bits and had been doing so for ever. With infinite labour we trudged on in a motionless landscape. Heavily laden, the camels could cover scarcely 2 miles in an hour, and sunset found us only 19 miles from our start.

During these first few days I was anxious to find out, among other things, what distance the camels could comfortably cover in a day's march. I did not therefore hold them to a set programme, but allowed them to halt when they seemed to have had enough. I found the effort of marching for twelve hours from sunrise to sunset, without a halt and at a snail's pace, very trying to my powers of endurance. And when at length the interminable crawl was finished, and I could make my bed in the sand, the prospect of a dinner of biscuit and cod-liver oil was not always alluring. But I found that this diet was as well chosen as it was unpalatable; I had not an hour's illness, or threat of illness, from start to finish. The soft yielding going soon tried my feet and started rubs and blisters that became permanent. But, although exposed to the air, the wounds remained clean and wholesome until my return to Dakhlat. For dressing I used vaseline only.

We took four and a half days to reach Bir Abu Mungar. They were uneventful days. Slowly we crept along the Gilf to Kings Hills, slowly we rounded the bend to the north, and slowly we branched off through the dunes to march straight on Abu Mungar. The Senussi here gave us a demonstration of his sense of direction. He made a bee-line for the well from a point 18 miles away under the Gilf, and when, the following morning, the rising sun lit up the cliffs ahead over the rolling sand, we were found to be marching directly on the solitary palm that marks this most desolate of oases. On February 8 we reached the well at Abu Mungar at two in the afternoon. We had tested our instruments, obtained a value for the wheel, found our rate of march, and formed a fair estimate of our powers. We had now to rest, allow the camels to eat their fill of the last grazing they would get for weeks, fill our water-tanks, and set forth. I employed this interval in taking several observations for

time and in checking my compass by bearings to consecutive sunrises and sunsets.

Mungar possesses only one well to-day, but to judge from the number of mounds bearing vegetation, it must have had several more in time past. It abounds in broken pottery of water vessels, but I could find nothing there of interest. It would probably be worth while to dig through some of the mounds. The site must be as old as those of the other oases and have been used from a remote antiquity. Stone artefacts have been picked up there, and thorough search should reveal matter of great interest to archaeologists. There used to be a small forest of tamarisk at the foot of the mounds, covering an area several hundred yards square, and the remains of trees of over a foot in diameter are to be found in places. But the whole place has been denuded of wood by travellers, possibly during the war, and a very meagre assortment of vegetation is to be found there to-day. The water is warm, as in all these oases, and is sweet and good. It emerges some 15 feet above the level of the surrounding flats.

My plans had been somewhat modified by the unwelcome discovery that 20 miles a day was all that I could expect from my camels, while their powers of enduring thirst were limited to seven days with comfort, to ten as a maximum. I proposed now to march on a bearing of 276° 30′ true for three and a half days, to make a dump at the point then reached, to send two Arabs and eight camels back to Mungar to bring water and grain, and to go on myself, westwards, with two Arabs and five camels for four days before turning back. I hoped to reach the frontier and the western edge of the sand sea. On my return to the dump I proposed to change camels and march for four days south-west, and then, returning *via* the dump, to go home. Once the march into unmapped country had begun my duties became more arduous. Every time that we crossed a dune or encountered some definite feature it was necessary to stop, take a note of the right and left revometer readings, and record the fact. It was necessary, too, to find some way of marking our tracks, which might be obliterated before our return. In the event they were wiped out several times a day by sandstorms, but at the start the weather was calm and had been so for some weeks. We even found tracks of a party of six men, ten camels, and one donkey, leaving Mungar for Kufra, and subsequent information showed these to be nearly a month old. I noticed that in many places on the Kufra route there were lines of camel droppings that appeared to be of uncertain age. From their numbers however I concluded that they recorded the journeyings of at the least a dozen years. This suggested to me the idea of making blobs of camel droppings at prominent points in the march. My first idea had been to take date-palm branches, like Colonel De Lancey Forth, in his march south from Siwa, but apart from the fact that they are liable to be overthrown, the number available at Mungar was small, even had we denuded the solitary palm there; a sacrilegious act I was loath to commit. My plan worked well enough, but the difficulty was to induce the Arabs to carry a sufficient quantity of droppings.

At 8.30 a.m. on February 11 we began to climb the long sand slope that introduces the traveller to the Kufra road and the sand sea. The difference

in height between the summit of the first dune crossed and water-level at Bir Mungar was 410 feet, as measured by my aneroids.

The first dune of cascading crests lies about 3 miles west of the well. The *seif*, or line of cascading crests, is low and easily crossed, and its general direction is roughly 158° 30′ true. I found great difficulty in taking the direction of dunes. There is only one satisfactory way of doing this, and that is to climb to the top of the highest crest available and take a forward and backward bearing along the line of crests. This operation takes a great deal of time and breath, but it is quite certain that no other method gives results of the slightest value. I found my estimates made from points under the top of a crest as much as 5° out on an average. From my observations of the direction of numerous dunes, I am inclined to doubt whether they are grouped with the regularity that has been claimed to exist. Frequently one *seif* will occur, running at a distinct angle to the line prevailing in the neighbourhood. Another interesting feature about these *seifs* is that, whereas they are generally to be found near the summit of whaleback dunes where these exist, yet they never quite coincide with the line of the latter, *i.e.* they leave the whaleback at some point in their course and frequently descend into the trough between two whalebacks. The tendency of the southern extremity of *seifs* to veer off to the east has been noted before, but I think that no explanation has hitherto been offered. I believe the most pertinent fact to be that the south end of a *seif* is usually much smaller in bulk than the rest of it. The consequence of this would be that a westerly wind would move it at a faster rate than the higher portions of the dune. A confirmatory piece of evidence is the fact that where a col of any length occurs in a *seif* it is usually lying slightly out of alignment with the rest of the *seif* and always farther to the east. The prevailing wind in the sand sea is held, on good authority, to be in the direction of the dunes, *i.e.* 340°–160° true. My own experience is slight, but during the thirty-five days I spent among the sands, on five alone was the wind from this direction. The prevailing wind was almost due west with a tendency to south. Clayton, of the Desert Surveys, whose experience of these wastes is second to none, told me, as his considered opinion, that west was the prevailing wind. If this should prove to be the case it would seem to modify the existing theory of dune formation. A further suggestive piece of evidence is the fact that it is very much easier to cross the sands from west to east than in an opposite direction, the east gradients being much steeper. I suggest that the difference between the direction of the lines of cascading crests and those of the whalebacks may be attributed to the comparative mobility of the former, combined with a change in the direction of the prevailing wind over a vast period of years. Possibly the prevailing wind during the immense period of the formation of the main dune feature was in the longitudinal direction of the dunes; but surely it is possible that a radical change in the direction of the wind has taken place and that what is in process of happening is the adjustment of the dune formation to the new wind direction?

At 1.20 p.m. on this first day of our western march we reached the summit of the seventh crested dune from Bir Abu Mungar. The aneroid showed a height of 700 feet above that of Mungar. Looking west from this dune, I saw a line of rocks and crags stretching south-west from El Guss Said. I took a

number of bearings to prominent features and made a rough sketch while the camels were catching up. Some miles ahead a long and very high *seif*, lower to the north, was visible. The seventh line of crests, on which we stood, was seen to be very chaotic, and frequently to break up into several parallel lines. The general direction of these was 154° true. We descended a drop of 230 feet before reaching the bottom of the valley separating us from the plateau of crags. The soil here appeared to be decayed limestone. We took advantage of a gigantic shoot of sand lying between limestone cliffs, to climb to the top of the plateau, which the aneroid showed to be at the same height as the preceding *seif*, or slightly over 700 feet above water-level at Bir Mungar. This plateau proved to be formed of limestone and marls, and the surface had been carved by the sand-bearing winds into the most grotesque shapes imaginable. The photographs I took of this stretch illustrate the gouging action of the wind. The tenacity of the limestone in this intensely dry climate allows it to be ground to a razor edge without collapsing, and countless whetted discs, an inch or two in height, stand erect along the cracks and emit a metallic tinkle when crushed by the foot of the traveller. Another curious phenomenon is the suggestion that the surface has been subjected to intense heat. It is profusely covered with black nodules that have the appearance of cinders. Possibly this effect may be attributed to the action of the ferric oxide of the sand on the limestone. The desolation of this high and ghostly waste of grey rock has a powerful effect on the imagination. Suddenly transported there one would suppose oneself to be on the moon. Here and there however, in the fissures and cracks, a small shrub may be found, generally dead. They proved most useful for firewood, and, when green, for fodder. Tufts of grass, too, are not uncommon.

It was here that I descried my first stone artefact, a mousterian palaeolith. It was lying on the bare rock on what had the appearance of an ancient road marked by tracks in the rock running at 192°–12° true. I came to the conclusion however that these were due merely to erosion along the lines of jointing at right angles to the strike of the rock. This angle should be noted because I found it to be universal in all the limestone formations I encountered. Every few miles the imagination of the traveller is stirred by what appears to be the remains of an old track, a long depression or series of parallel depressions a foot wide, filled with sand, continuing as far as the eye can see in both directions and frequently edged with vegetation. These must not be mistaken for tracks. They are nothing more than the weathering of the rock along the lines of jointing.

After traversing this extraordinary waste, we scaled the *seif* on the far side and found before us a second expanse of limestone plateau, covered with craggy formations that reminded one of anthills. This plateau was 50 feet lower than the first. We descended into it as the sun went down, and, after stumbling on for a couple of miles, found a bed of sand silted up against a line of rocks, and there made our camp. We had marched only 19 miles in ten hours.

The morning of the 12th dawned calm and benign after a cold night, and we were away soon after sunrise on the same general bearing of 276° true. After marching 4 miles we climbed a high *seif* dune (the ninth encountered)

running at 163° true, aneroid reading 1944 feet, or 660 feet above Mungar. From the top of this plateau an expanse of the plateau of El Guss Said of about 12° extent was clearly visible at 30° east of north. There was another long expanse of fairly even decaying limestone between this dune and the next to the west. We trudged painfully through the heavy powdery sludge that covered the surface here. This mixture of sand and decomposed limestone is frequently over a foot in depth, yet its surface is covered with stones and pebbles of the cindery appearance before referred to. There are more of these on the surface than under it. As the top 3 inches is usually pure sand, which must have been carried there by the wind, whilst the pebbles are limestones or marls from the floor, there would seem to be a tendency for the sand to lift the stones on to its surface and carry them there. A large stone left on the surface of a dune will remain on the surface although the sand in the neighbourhood is continually moving. This might be explained were the effect of the stone to form air eddies that would lower the level of the surrounding sand. But this is not the case, the level of the sand being invariably unbroken in the neighbourhood of the stone. The next *seif*, the tenth, was over 3 miles away. It runs at 170° 30′ true. The aneroid reading at the summit was 1930 feet. A double *seif* lay at a distance of a mile to the westward. Crossing this we traversed a rocky limestone floor for nearly 4 miles until we met the twelfth *seif* and halted on the summit to allow the camels to catch up. The aneroid showed a drop of 40 feet below the ninth dune crossed.

All this time Es Senussi was jogging along at a beater's gait just beside me. I was pushing the wheel and choosing the line of march, while the camels, walking free and untied, followed in the rear. The weather had been fine, the wind light and from the north-west. Clouds frequently filled the sky, but there was no rain, and I was able to entertain the hope that the replenishing party would simply follow our tracks back to Mungar. From the top of the twelfth *seif* a distant prospect of the sands to the west was obtained. They swelled gently upwards with occasional crests. The immediate prospect was of a valley bottom about 4 miles wide, filled with curious rock formations resembling chessmen. From the next dune we saw a high *seif* 4 miles ahead, separated from us by a valley similar to the one we had just left. We marched on without waiting for the camels, and the sun went down just as we reached the shelter of the dune. Here we had perforce to halt until the camels should arrive. There was no sign of them, and shouting and whistling elicited no response. I had taken the precaution of carrying with me an electric torch. I now gave this to the Senussi, who went back on our tracks, while I sat down on the soft sliding sand to wait. After half an hour I heard an answering shout, and in a few minutes the whole party arrived. They had veered off our tracks after some firewood and had failed to find them again. There is some danger in marching ahead of one's transport in these wastes. If anything does go wrong there is nothing to be done but to attempt the impossible feat of returning to the oasis without food or drink. The night was a cold one, as usual. The following day, February 13, we made an uneventful march, crossing thirteen *seifs* in all. After the twenty-second crossed these crested dunes began to grow shorter in length, averaging from 1 to 3 miles as compared with the 10 or 12 miles of the easterly dunes. They were closer together than on the first two

days, averaging little over a mile apart. In the valley bottoms the limestone was still exposed, although occasionally completely submerged in sand.

Between the twentieth and twenty-first *seifs* we set up a mark composed of some sandstone rocks we found in the valley bed; and on the east slope of the twenty-first dune we found camel droppings of uncertain age. The animal was apparently *tibn*—or straw—fed. As the whole of this area is on the way to nowhere and unknown to the Arabs, this find was something of a mystery. I made the following note on the summit of the twenty-third dune: "outlook, dunes in all directions—nearly all interspaces sand." The only other feature of interest encountered during this day's march was the trunk of a tamarisk, some 6 inches in diameter. Nothing approaching that size could grow in this area to-day. This phenomenon is to be found between the nineteenth and twentieth *seifs*. I have marked its position on the map. The floor height which the aneroid showed at round about 1650 feet throughout the day rose to 1818 feet before the halt for the night.

The next day, February 14, we marched on approximately the same bearing for 11 miles. As we went on the stony interspaces between dunes died out and the *seifs* became fewer, giving place to rolling sands of indeterminate formation. This was the day on which we had to make our dump and send back the replenishing party. As we drew near to the appointed area it became evident that no prominent features existed that might act as a landmark to guide us back to the dump, and I was forced to choose for this purpose a high roll in the sands visible from a distance of 2 or 3 miles in all directions. Here we barracked the camels, and I set up the theodolite with a view to taking observations of the sun for time preparatory to finding latitude that night.

The return party, consisting of Abu Bekr Guwaya and Abd Ar Rahman, reluctantly prepared for an immediate start for Mungar. Somewhat mollified by a farewell cup of tea, they presently bid us a pious farewell, and were soon hidden amongst the eastern sands. On this day we encountered the first traces of bird life. Some 2 miles from our start I noticed two hawks perched on the summit of a solitary crested dune. They flew off as we approached, and I found a quantity of feathers belonging for the most part to small birds of the wagtail variety, but there was one large green feather that must have belonged to some species of drake. A little farther on I picked up the skeleton of a crested crane. We encountered several brilliant green shrubs, usually growing halfway up a whaleback dune. They were very bitter, and the camels ate sparingly of them. To overcome the difficulty of fixing the legs of the theodolite in soft sand I inserted them in buried biscuit tins. I found this method fairly satisfactory.

Soon after sunrise on the 15th we set out again. The morning was warmer than usual, the thermometer reading 70° F. at 10 a.m., in place of the 60° usual at that hour. The wind had veered round to 10° south of west, and wind-borne sand was tracing long pale lines across the surface of the desert. I hurried on ahead of the convoy, now reduced to two men and five camels, and presently descended into a valley whose bottom was partly uncovered and was formed of a hard white glittering rock which could be scratched with a penknife. Two conspicuous red sandstone boulders, some 2 feet 6 inches high, and liberally covered with birdlime, marked this valley.

Beneath one I found a solitary egg, about the size of a bantam's, mottled closely all over with brick-red and sienna. On the rock beside it sat a hawk or eagle with white breast and dark-brown wings, about the size of a peregrine. This has been identified by the British Museum with *Falco Biarmicus Tanypterus*, the Nubian Lanner, which is the usual falcon in Sinai and Egypt, but does not extend west of Alexandria or to the oases of the Western Desert. The foot agrees best with this bird, but it might be the Barbary falcon *Falco Peregrinus Pelegrinoides*. Here too I picked up the wing of a buzzard, not identified. The neighbourhood was full of jerboa holes and tracks. The means of subsistence of the latter is something of a mystery. I suggest that they feed on the desert silver wings and a four-legged spidery insect which abound everywhere, and which presumably derive their moisture from the atmosphere. The diet of the hawk was revealed by the numerous skeletons of birds of all sizes that lay scattered about. Among these were no water birds. Several appeared to be some kind of partridge. I took two skeletons of these, but they were unfortunately left with some empty tins at one of our camps.

On the summit of the *seif* immediately west of these rocks I noted: "All this country is a confused mass of irregular sand formations, traversed by short and intermittent *seifs*." Towards evening we entered an area more prolific in *seifs*, under one of which we camped for the night. We had marched 20 miles since breakfast. In the afternoon a complete calm fell on us, making the going in the hot sun very exhausting.

The following day we marched on over similar open country for 10 miles. The going was too undulating to be good, and we were continually having to circumvent steep gradients, that would suddenly confront us without warning. We met with an occasional dead shrub, and, here and there, traces of bird life. We halted at 2 p.m. to water our camels, which showed signs of exhaustion. I had intended to keep the water I had reserved for this purpose until we had reached the westernmost point of our march, but it was obviously better to depart from this plan and to relieve the camels of the weight of water and fantasses at once.

During the night a wind sprang up from the south-west and we awoke to find ourselves half buried in sand. Our tracks of yesterday had completely disappeared and the landscape was partially obscured by flying sand. A heavy haze hid the sun and the horizon until 8 a.m. The Senussi informed us that he had always understood these phenomena to occur when travellers approached the neighbourhood of Zerzura. He said that it was due to the action of the Djinn who inhabited that spot. Thus encouraged we marched on, and, after covering 3 miles of undulating sand, crossed a high *seif* that was moaning faintly in the wind, and throwing off a spray of fine sand from its razor edge. A black object on its western face attracted my attention and proved to be the carcase of a camel. It lay within a few feet of the top of the crest, almost completely uncovered. The sand around was stained with an oily substance and had become as hard as rock. It is impossible to say how long the carcase had lain there. It was completely desiccated, the hide still covered with hair, and the pads of the feet whole. It might have been there for ages, and, with nothing to hasten decay, must have lain a good many years

to reach the state in which we found it. I could find no distinguishing marks on the hide although I searched for them.

All this day the wind rose, veering to the south, and the flying sand stung the exposed portions of our bodies and obscured the landscape. The mental discomfort of marching under these conditions was great. The camels liked it even less than we did. They had a miserable tucked-up appearance, and they huddled together in a bunch. During every day on which sand blew on my march the temperature rose. The wind on these occasions was always south of west or due south, and a heavy haze hid the horizon, sometimes to a height of 15°.

We marched on, avoiding the short *seifs*, over rolling sand. Owing to the obscurity I had to abandon my practice of marching on a point ahead, and, handing over the wheel to Es Senussi, marched with my compass open in my hand. Occasionally the monotony of the sands was relieved by patches of gravel, lying on a bed of fine white sand, possibly quartzite. I hoped that these pebbles would retain our impression, but except in one instance, all traces were obliterated a few hours after we had passed. From the top of a *seif* crossed in the late afternoon we had a glimpse of a land of more numerous *seifs* to the south-west. Where we were marching the country remained very open. At 3 p.m. the temperature was 80° F., and the sun obscured. Shortly afterwards we crossed a well-marked line of *seifs*, on whose slopes we found two or three green bushes. The sand and wind had delayed us and we marched on for an hour in darkness to make a total of 19 miles for the day. We camped in a trough in the sands, and with the aid of boxes and fantasses contrived a fair protection from the wind. The aneroid read 880 feet above Mungar.

On the morning of the 18th I awoke to find a quail resting among my water-tanks. It flew off but settled a few yards away, as if tired and uncertain where to go. The wind had veered round to west again and was milder. There was fog over the desert. Realizing that our achievement was even less than I had expected, I had altered our course northwards to 300° true, in order to reach the area I had marked as the possible site of Zerzura. We set out therefore on this bearing, and presently came to a steep bank that forced us northward. On mounting the summit of this feature I saw amidst drifting sand a black blob at 12° true. Thinking it must be a rock or tree, I turned and marched on it. As we drew near its appearance became more intriguing, and, suddenly, I saw it was a car. I was exceedingly surprised and not a little chagrined to find the hated symbol of civilization in a place to which I had penetrated with so much labour and effort. It proved to be E.G. 1269, belonging to the Desert Surveys of Egypt. It was standing on a prominent mound, apparently derelict, and the wind was already carving caverns beneath its wheels. The engine started easily, so it was evidently to be called for, and I left a note lashed to the wind-screen and addressed to Clayton, to whom I assumed it belonged, giving my news, and regretting that we had not met under such unusual circumstances. I further asked him to make a note of the longitude and height as an invaluable check on my computations.

That done, we resumed our march on our bearing of 300° true. From time to time I recognized with dismay the half-obliterated tracks of Clayton's cars in the shifting sand. Green bushes became very numerous in the bottoms, and

the stretches of gravel on white sand, called *serir* by the Arabs, more frequent. *Seifs* were few and insignificant. As we went on the wind increased until we were marching blindfold into a whorl of stinging sand. As the last of the daylight was fading, something black and formidable loomed up ahead, and soon afterwards we met an unsurmountable *seif*. Hoping to find shelter in its lea, we chose a suitable place on the *serir* and made camp. We were in an eddy and handfuls of sand were thrown about like snowballs in all directions. Perhaps even so it was better than the open. I added grapefruit and sand to dates and cod-liver oil for the evening meal, and the Senussi, after a number of failures, contrived to get a fire alight beneath some water-tanks and made some tea. The dune under which we lay all night never ceased to whine. In a high wind a *seif* makes a noise like that emitted by a glass funnel placed over a bunsen burner and magnified a few million times. I slept badly, kept awake by visions of a storm lasting for days. I found that one of our remaining tanks had lost half its contents from leakage through the screw top, unreported by the Arab who watched it happening, so that we had enough for ourselves for seven days and no more.

By dawn the wind had dropped, and although the sun was invisible and the air still filled with flying sand, it was possible to see where we were. Realizing that we could not travel very much farther westward I left the camels where they lay, and went on myself across the dune for a while. It grew clearer every moment, and by 9 a.m. I could see some miles ahead. I was on a great expanse of *serir* with no more *seifs* visible to the west. The Senussi said he recognized the country as belonging to the type traversed by the Siwa–Kufra direct road, and that it marked the western end of the sand sea. It will be seen from the map that this line is the continuation of that marking the western extremity of the dunes on the Kufra road, as described to me by the Senussi. Although personally satisfied that the sand ended here, I did not take it as proved before meeting Clayton. He had been as far as the frontier and had come to the end of the sand sea on about the same line. Now that our enterprise had failed there was nothing to be done but to retrace our steps to the dump and try again on a south-westerly bearing.

Although I had marched the last 15 miles blindfold I was successful in finding my way back to Clayton's car by the use of my log book. In fact, in my dread of losing the way, I found that I had noted many more features, and with greater accuracy than was normally the case, and I had no difficulty in retracing my steps. We found the car half overturned but no sign of Clayton. My message was still tied to the wind-screen, and there I left it. It had been my intention to return by a different route, but knowing that the sandstorm had obliterated all tracks and might have buried the dump, I did not dare to leave my log line. I could, of course, have taken a latitude when near the dump, and made reasonably sure of hitting it off, but it was taking a chance, and, as events showed, an impossible one.

On the way back I amused myself by taking short cuts. I was able to do this owing to the fact that the going from west to east is very much easier than in the opposite direction, the eastern gradients being very much steeper than the western. My mind was continually occupied with the problem of the origin of the soft patches that occur continually and without apparent method

all over the surface of the sand. Sometimes these patches are not more than a foot wide, in which case they are usually several feet long; sometimes they are circular with a diameter of anything between a couple of feet to 100 yards. In the middle of these larger patches solid spots, a yard or so across, will occur. Some patches will give beneath the foot of a camel but remain firm to the tread of a man. I observed many hundred of these spots and arrived at the following conclusion: that while it is impossible to tell from the appearance of a sand surface that it is not soft, spots occurring in all types of surface, it is frequently possible to say that it is soft. When there are a number of grains on the surface larger than the prevailing size, and particularly when there is purplish appearance, the odds are that the sand is soft. This purplish appearance is due to the colour of the large grains, but I believe it is only apparent when the size of the smaller grains with which they are mingled is smaller than the average size of grain in the sand sea. This gives them a whitish appearance, why, I cannot say, but it is so, and this whitish hue emphasizes the purple tint of the large grains, which do not normally show up from any distance. Thus when one sees a purplish patch one may say, firstly, that it will be soft, and secondly that it consists of a mixture of exceptionally large and exceptionally small grains, that is of grains of very unequal sizes.

There are two types of sand to be found in the sand sea. One, the prevailing type, is very rounded, the colour of yellow ochre, and almost invariably uniform in size. Cascading crests are invariably formed of this type, and so are the great majority of whalebacks. The second type I will call the underlying type, as it is only found emerging from under the main dune and rolling sand formations, frequently in the troughs between dunes, but mainly in wide flat expanses, more especially near the western verge of the sand sea. The bulk of it is composed of grains smaller, whiter, and much less rounded than the first type. Sometimes these grains are so small as to resemble a white dust. Large irregular grains and gravel are very apt to be found with it. These facts seem to suggest that the main dune formations of the sand sea are an importation of later date than this underlying sand, and that they have been subjected to the action of the wind to a much greater extent.

At 9 a.m. on the second day of our return march we were just about to strike camp when we heard the sound of an internal combustion engine approaching over the dunes behind. A moment later a Ford box glided over the summit of the whaleback, and Clayton, armed with a twelve bore, got out. He had seen our tracks and camel droppings next his car on his return that morning, but had failed to find my note, and so was prepared for anything. He told us that he had made a camp in the hollow under the sand mass on which the car rested, with tents pitched and a man in charge. It seemed incredible that we could have missed it twice in succession and illustrates the ease with which one can get lost in these sands. We had a long talk, sitting on the sand in the sun, and he told me about his wonderful expedition into Gilf Kebir, *via* the frontier, with three Ford cars. He had got into a corridor between dunes 200 metres high, and, on one occasion, after going 70 km., had come to an unsurmountable barrier, and had had to turn back. This occurred on his way home and ran him so short of petrol that had it happened again he would be there to this day. He had actually traversed the very area

I was proposing to search on my second attempt, and we agreed that my doing so would serve no useful purpose.

The remainder of that day we marched on the log reversed, hoping to hit off our abandoned and empty water-tanks by dusk. Darkness found us uncertain of our whereabouts, and I was forced to spend half the night in trying to get a latitude. It was cloudy and the most suitable stars were already past the meridian. However I at length succeeded in getting a result which showed that we were on the same latitude as the tanks, and must therefore be east of them. The morning revealed them black and conspicuous, a couple of miles to the rear. We had passed within 200 yards of them.

The rest of the march back to the dump passed uneventfully enough in calm and pleasant weather. On the afternoon of the 22nd we reached a point which we recognized as being in the neighbourhood of the dump. There was no sign of the latter, although it had formerly been visible from this point, and we were marching straight past it when, on glancing to the left, I saw a black object in the sand about 200 yards away. This proved to be a water-tank lying on its side, and this was all that the storm had left visible. The rest of our tanks and stores was buried. We found that one fantass had been turned over on to its bung and most of the water had escaped, but the rest were intact. There was no sign of Abu Bekr and the camels, so I busied myself in making landmarks to attract their attention. They arrived the following morning. They explained that when the sandstorm occurred they had been at Mungar. They had assured each other "Certainly the Bimbashi will not march to-day," and from this erroneous deduction had concluded, quite illogically, that I would arrive a day late at the dump. Had I still cherished my first project, this would have been infuriating; as it was it mattered very little.

On the return march I was careful to take a number of bearings along the top of *seifs* to check my previous findings. On several occasions I found a difference of 10° between adjoining *seifs*, but there was a general direction for *seifs* west of a line about 20 miles west of Abu Mungar, that I found to be 165° true. Occasional departures would occur in excess of this angle, *i.e.* towards the north and south line, and the difference might be as much as 10°. The dunes lying immediately west of Mungar have a general direction of 158°. Altogether I took thirty or forty measurements, of which the limits were 170°–152° true.

There was evidently little to be gained by adhering to my first intention of making a second journey to the south-west. I was however provisioned for at least another fortnight, and the only question was how to spend this time with profit. At this time I still believed that the track-like grooves in the surface of the rock we had passed on our first day's march from Mungar were the vestiges of an old road. Their direction was intriguing inasmuch as it led to no known oasis, and I felt that in following them I should at least find some traces of the people who had used them. The tracks pointed towards Regenfeld to the south, and would traverse a practically unknown tract of desert. I decided to return to these tracks and make a preliminary investigation for three days while a party returned to Mungar for more water and grain. On their

return I planned to follow the tracks to the south for as long as my supplies and water held out, and then to march back to Dakhla.

The march back to the tracks was uneventful. Tempers were short and it was here that I first discovered the excellence of Abu Bekr Guwaya. He was a perfect peacemaker; never tolerated a quarrel, or would allow the parties thereto to rest until it had been composed; to do which he had usually to sacrifice his own interests. In addition to this he was our cook, tailor, and odd job man. Suleiman Foula, the boy, who had hitherto proved invaluable, and Abdurrahman began to run out of tobacco and relapsed into a condition of irritable melancholia in consequence. I sent them back to Mungar and kept the other two with me.

The day before we reached the tracks I was walking across a stretch of soft sand and pebbles that lay in the shadow of a high *seif*, when I caught sight of something that glittered in the rays of the setting sun. It lay by itself in the centre of a clear patch of sand and in shape resembled a spear-head. This was the second artefact I had found. I spent an hour in searching the neighbourhood, and found two or three more artefacts of similar pattern. This site is marked on the map.

On the morning of the 24th we reached the tracks, and for the next three days I made a thorough search of the neighbouring desert. Shortly to the south of the point at which we had met the tracks was a line of limestone cliffs. Mindful of the opinion of Dr. Ball, that the most promising sites for palaeolithic or neolithic remains are to be found at the foot of cliffs or other shelter from the wind, I conducted a search along the foot of these cliffs for some miles. I found two artefacts only. Possibly the absence of remains may be attributed to the excessive weathering of the limestone, but whatever the reason, not only did I find practically nothing here but the foot of every other cliff I encountered proved equally barren. I formed certain definite conclusions as to the nature of the sites where artefacts may be looked for with every hope of success. These I will describe in due course. We found a number of recent traces of camels amongst these cliffs. From the way in which the tracks branched off to ascend unlikely places, and the existence of a camping place that to judge from the quantities of dung, rope ends, date-stones, and embers it contained, must have been used a great number of times, it is possible that this area is used as a hide for contraband. My Arabs were of this opinion.

On the morning of the 28th we met the returning party from Mungar with the provisions we required for the march, and in the afternoon we said good-bye to them again and marched on a bearing of 161° until dark. I had by this time satisfied myself as to the nature of the "tracks" I had hoped to follow, and had decided merely to return to Dakhla by a detour through the dunes, instead of by the usual road. That night we were tormented by rats. (These have been identified by Mr. Kinnear of the British Museum as *Gerbillus Pyramidum*, which is found all over Egypt, Sudan, the Sahara, and all North Africa from the Red Sea to Algeria.) They ran over our feet, gnawed holes in our grain bags, and generally made the most of their windfall. I woke up to see the Senussi kill the last of them with his bare hands, after a short but exciting chase over the sands. How these creatures support life is a mystery. True we were sleeping on the Kufra road, but even if all the rats were able to find

Fig. 1. Two faces of a leaf-shaped point on tabular chert, pressure-flaked, with serrated edges, found at long. 27° 1′ E., lat. 26° 34′ N.; age neolithic

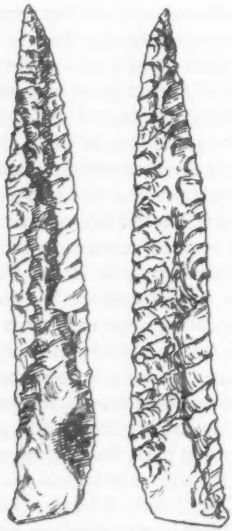


Fig. 2. Two faces of a knife of neolithic age, pressure-flaked from tabular chert, found at long. 27° 31′ E., lat. 26° 16′ N.; the type is dated in the Fayum middens at probably about 5000 B.C.

Figs. 3 and 4. Blades found at long. 27° 31′ E., lat. 26° 16′ N.; age probably mesolithic, or neolithic of Caspian tradition. (These four artefacts are all reproduced here at half size.)

and feed on every party that passes along this road (which is most improbable, as the so-called road is at least 10 miles in width at this point) it is difficult to see how they could in a year rob four or five parties of sufficient provender to last them for the rest of the time. They were in excellent condition, fat and, as the Arabs proved by experiment, tasty. They had no appearance of disease of any kind. I found the magnetic variation here to be 2° west. This value was exceptional, for every other one I obtained was within 20′ of a degree west. The difference is probably attributable to purely local influences.

On March 1 we started off on the same bearing soon after sunrise. We were marching between two *seifs* that lay about 3 miles apart, and very nearly parallel to them. There is very much less sand in this area than to the west. What there is is heaped up into crested dunes of little over 100 to 150 feet in height. Between these dunes the underlying limestone is usually exposed and the curious cottage-loaf and anthill-like formations characteristic of the limestone in these parts are numerous. The general configuration of the desert is very simple here. It is composed of very regular limestone strata, dipping imperceptibly to the north. Every 20 miles or so occurs a regular line of cliffs facing south, 100 feet to 200 feet in height. At the foot of these is more limestone strata, very little broken and scarcely at all disturbed, that extends for another 20 miles or so. This goes on for the best part of 100 miles and possibly farther.

As we marched on, the distance between the *seifs* increased to about 4½ miles. Occasionally the soft decaying mulch underfoot would give place to a hard brittle white limestone full of fossil shells and ammonites. After marching 14 miles we came on one of these patches lying close under the *seif* to the east. It formed a distinct depression as far as the hard limestone in the neighbourhood was concerned. A few hundred yards to the south were a number of well-marked depressions with steep and crumbling sides, formed, presumably, by the action of the wind. The hard patch was marked by the dead trunk of what must have been a fair-sized tamarisk. There was an old growth of wood around the trunk which was perhaps 8 inches in diameter. Round about were two or three mounds. Here we found quantities of flint splinters, ostrich shells, and fossilized sea-shells. I sat down to let the camels catch up, and began idly fingering some of the flint splinters. Suddenly I noticed that many of them were serrated along one edge. I got up and began to search for more. I soon found several pestles and grindstones, and innumerable flint knives. I collected a number of these as specimens. These have since been classified by Miss Caton-Thompson as mousterian palaeoliths.

It occurred to me that a knife factory of such importance should have at least one hearth that would be recognizable as such, and was presently rewarded by uncovering two, that lay concealed under a couple of inches of sand. The ashes covered a circle of about a yard in diameter. No doubt there were others, but I had already spent over an hour in the search and was compelled to go on.

We had not moved 50 yards from these ancient hearths when we came on an oval depression in the ground that, at first sight, resembled nothing so much as a dewpond. Beyond and in line with it were several extensive, ragged depressions, the last over 2 miles in length, and from 20 to 30 feet deep. These had evidently been carved out by the wind. I suggest that in that remote age

when the desert was overrun by the unknown race whose flinty tools so numerously besprinkle every spot where the hardness of the rock has defied the agents of decay, which have made the rest of this limestone waste a crumbled and crumbling heap of ruins, nothing can be more probable than the existence of some artifice for inducing condensation of the nature of dew-ponds. When the growing desiccation and dewless nights brought absolute drought these would be deserted, but their site would be the first to invite denudation by the wind, and it is improbable that any positive traces would remain to this day. I suggest that what we saw in this ancient knife manufactory was really a dewpond, and that its presence alone would make occupation by man a possibility. Dew still occurs in the sand sea. We were twice wetted by it.

I came to the following conclusions with regard to probable sites for flint and other artefacts: (1) It is generally a waste of time to search for these in soft decayed soil. Not infrequently I found the large sandstone platters for grinding grain in soft spots, and a search usually revealed the accompanying pestle of hard white-rock, quartzite as a rule, but of flint artefacts there was not a vestige. (2) Whenever a hard flinty patch of limestone is encountered it is well worth one's while to look for artefacts. It is no exaggeration to say that, in this area, they are usually to be found on such patches. (3) These patches do not occur at the foot of cliffs and boulders in the majority of cases, indeed, there is every reason against their doing so. They are generally to be found on the great wastes of flat limestone, in places very little denuded by the wind. It is very probable that the majority of the sites I discovered were manufactories. In most of them the flints from which the artefacts were made occurred in the soil at the place where they were found. Many, too, had an unfinished appearance, and may have been discarded as failures. The quantities of these remains is really very striking. I grew weary of continually finding them in the likely spots. My two Arabs, who supposed that they must possess magical properties, or some other practical use, were continually running up from the rear with a large grinding platter in their hands. One of these was all I wanted, so I threw away the rest on the spot, but I was considerably impressed with their multitude. I kept a record of the number picked up. It was twenty-five. It must be remembered that we were marching in a straight line at as fast a pace as we could maintain, that we were weary and not particularly observant, so that we saw only the most conspicuous of these remains.

That night we encamped halfway down a limestone escarpment some 150 feet in height, that faced south. The escarpment was very much broken and abounded in fantastic castellated effects. The aneroid showed 400 feet above Mungar. Next morning we crossed the *seif* to the east, and began to march up the valley on the far side. This valley was half filled with sand, and as we went on I noticed an extraordinary phenomenon. The sand, which sloped somewhat steeply down towards us from an escarpment in front, was liberally covered with wet patches. These varied from 1 to 10 yards in diameter. They could scarcely have been due to rain, firstly, because there had been none for at least twenty-four hours to our knowledge, and secondly, because, while the patches were wet to the touch, the neighbouring sand was absolutely dry. The whole area was honeycombed with the holes of jerboas

and a fair number of tufts of dead grass were sprinkled about. The Arabs were as mystified as I was. I can only suggest that rain had recently fallen over the whole area, had collected on the surface of the limestone, and was emerging at the surface at various points in the sand slope. The sand was damp to a depth of 2 or 3 feet under the patches, which was as deep as we could dig in the time.

We marched on for another 12 miles over rather more broken country than we had yet met with. The *seifs*, which were very low, began to close in on us. Early in the afternoon a prominent limestone escarpment running in the usual direction leaped into view to the south-west. At about the same time I noticed several parallel lines of grass tufts running at 190° true crossing our line of march. I followed them for a mile and they continued. There were no tufts visible to either flank, and I inferred that these might mark the tracks of some ancient road. The road to Kufra is marked in this way in places and it seemed the most reasonable explanation. I decided to follow the tracks for as long as my provisions would hold out. I was confirmed in my belief that I was on a road by the discovery that the line carefully circumvented dunes and other obstacles, and that it led up to a very prominent sugar-loaf rock of limestone 40 feet high that would be visible from half a day's march to the south-west. We camped for the night on a stretch of sand north of the beginning of a *seif* and about 3 miles from the next *seif* to the west, the Arabs somewhat cast down by the receding prospect of Dakhla and rest. A serious situation was arising with regard to food. I had enough dates and biscuit to last me two days. After that I should have to rely on a small quantity of wholemeal flour I had kept, perhaps 2 lb. The Arabs were no better off. They had finished their sugar and were sweetening their tea with some extremely dirty dates. However we had plenty of pulse for the camels and so were in no danger of starvation.

The aneroid showed our height this night to be 490 feet above Mungar. We were on a vast flat expanse of limestone thinly covered with sand. The following morning, March 3, we started on a bearing of 190° true as before, the lines of tufts still keeping pace with us, and after marching for 6 miles began to ascend what proved to be the eastern edge of a mass of chaotic *seifs* running at 162° true. On the way we were suddenly thrilled to observe what appeared at first to be an enormous herd of antelope coming over the sand about a mile ahead of us. As they approached we saw that they were birds, flying in a perfect wedge-shaped formation about 20 feet above the surface of the desert. They approached rapidly to within a couple of hundred yards and then wheeled half-right and were soon lost among the northern sands. As they passed with a heavy flapping of great wings I knew them for crested cranes, —gharnuk, as the Arabs named them. By this name, too, are they known in the Sudan. The direction of their flight when first we saw them was almost exactly that of 'Uweinat, continued to the north it meets the west branch of the Nile Delta at the coast. Possibly the flight would rest in the oases of Farafra or Bahariya by the way. Could they have flown straight here from Erdi, 550 miles, or did they rest by the way in Gilf Kebir? They had certainly not come from the Nile valley. It is quite evident from the number of hawks that inhabit the sand sea alone (I saw twelve, all of the same species, the size of a peregrine, with white breast and dark wings) that the whole area is continually traversed

by migratory birds at this period of the year. The fact that I found an egg, new laid by one of these hawks in a scooped-out hollow in the sand under a rock suggests that the season of most profitable hawking must have been beginning towards the end of February, and must have been expected to last at least until the resulting chick had acquired the strength to fly to better hunting grounds, say three months at a minimum.

After traversing a wide sandy plain with frequent patches of soft and hard limestone, the latter almost invariably containing a flint artefact or two, with occasional flat, round, hollow discs of a hard sandstone, reddish in hue, which were probably used to grind grain, we began to climb a *seif*. Halfway up we met the grass tracks again, very flourishing here. Two tufts especially had retained their full stature of 18 inches, and were very bushy and plentiful. On the top of the *seif* sat a hawk with black wing tips. His breast I could not distinguish in the glare. Directly we had topped the *seif* we found ourselves in a chaotic mass of crests, perhaps 2 miles wide. Tufts of perfectly fresh green grass were numerous among these crests. We emerged the other side to find the usual flat expanse of limestone desert with occasional cliffs. Our line of 190° true pointed straight at a high outcrop on the horizon. The next *seif* to the west was several miles away.

The march to this Gilf was uneventful. I reached it a full hour before the camels but was disappointed to find nothing there of interest. A strong wind was blowing from the south-west and the sand was rising. I chose a camp for the night and prepared to take a latitude. I found my latitude to be 25° 29′ 19″, taking three pairs of stars and getting very accurate results. I plotted in the march and found the longitude to be 27° 29′ 40″. This value was roughly checked by the ensuing march to Dakhla and was approximately correct. The aneroid read 700 feet above Mungar. Ahead lay Regenfeld and fairly well-known country. There seemed little to be gained by going on, especially as our food was running out. Qasr lay at 81° true, according to my calculations, and thither we now turned our steps.

On the morning of March 4 we set out across the limestone desert that separated us from Qasr. We marched for 8 miles before reaching the first *seif*, running at 158° true. This was a double *seif* at this point. At its foot I picked up some bird remains, the skeleton of a crested crane, and the foot of the short-eared owl, *Asio Flammeus Flammeus*. I am informed by Mr. Moreau the ornithologist that this is the first time the latter bird has been identified so far in these deserts. Half a mile farther on was a second *seif* running at 160° 30′ true, and 2 miles beyond a third *seif*. These *seifs* were separated by stretches of limestone and marls. Brilliant white pillars and shelfs began to appear, and made convenient landmarks on which to take bearings. The predominant feature in this stretch was the prevalence of a tough and wiry shrub that grew in the joints of the rock with a profusion that was as unexpected as it was welcome. We were badly in need of firewood, and here was fuel for an army. The magnetic variation here was only 15′ west. As we went on the ground fell slightly to the east, the wind veered to north-east, an unaccustomed quarter, and the cold was such that I was glad to wear my mackintosh in the heat of the noonday sun. There was very much less sand here than to the north-west. What there was was all swept up into low and short *seifs*. We

camped for the night of March 4 in the shelter of an overhanging crest, in the soft sand.

At dawn on the 5th I climbed the sheltering crest to scan the eastern horizon. The massive Glif that runs all the way from Mungar to Dakhla was plainly visible. At sunrise we marched on the same bearing. After a rapid walk over hard limestone, we crossed a *seif*, double at this point and running at 158° true, from the top of which I recognized Jebal Edmonstone at 81° Magnetic. We were marching on the very point to which I had measured the angle from the map. Ahead was a single group of low *seifs*, beyond which we could distinguish a confused mass of hillocks and hollows, mingled with brilliant white pillars and shelfs of limestone. We marched on over these ultimate *seifs* into a country of broken limestone formations, with marls and occasional sandstone. Crystals of calcite frequently occurred in this stretch.

And now, for nearly 30 miles, we marched through duneless country, a very desolate land of innumerable limestone hillocks. Every here and there we would find an artefact, but the march was as devoid of interest as it was of hope. Ahead lay Dakhla and ignoble ease. Behind lay all our dreams, and all the endless promise of the sea of sand. On the morning of the 6th we met the dunes again. By the map they were long overdue. There was no wind, and the sun was a ball of torturing flame throughout an endless day. I was determined to reach the sound of human voices before night, and when sunset found us on the verge of the final group of dunes that flank Jebal Edmonstone, I sent Abu Bekr Guwaya ahead, on one of our lightly laden camels, to give warning of our approach and to prepare the first meat we had tasted for five weeks. He rode away from us through these dunes in miniature, much to the chagrin of Es Senussi, who felt that he was the proper person to dispatch on such an errand. These dunes are wrongly marked on the map. Their eastern verge runs at 180° true. They are much redder than is usual, or they appeared so in the rays of the setting sun. I let the Senussi drive the camels, and followed some distance in rear. They were very attractive dunes. After the giants of the sand sea they seemed playful. One could take liberties with them.

Gebel Edmonstone kept its distance with customary obstinacy, and it was after midnight when we reached the friendly shelter of Sheikh Maihub. We had marched 38 miles since sunrise. Near the well Abu Bekr was busy broiling a turkey with rice, and, for the last time, I dumped my boxes on the sand and made my bed beneath the stars. I had finished my preparations for the night and was peacefully enjoying my nightly indulgence in the mellow periods of Hume's 'History of England,' when I was called to partake of Dakhla hospitality. The three of us sat down to meat and said not a word until the last of the turkey had gone to make good the abstinence of five weeks. Then we stretched our tired limbs for a last night on the sand. Our enterprise was over.

Next day I enjoyed the luxury of a bathe in the hot spring that perpetually overflows in the gardens of Maihub. Here too I parted, without regret, with certain importunate companions of the march, of whose presence I had been uncomfortably aware for some days. I made an excellent lunch of newly baked bread, an original soup of yolks of egg and limejuice, very piquant, two or three broiled chickens, and a dish of giblets. Mansour Bey arrived in the afternoon in a Ford, accompanied by ten friends from Qasr.

I bade a rather sad farewell to my faithful Arabs, and, after another meal at the Omda's, set out for Bilat with Mansour and Brinz, the son of the Omda of Bilat. As we drove through the pleasant gardens of the oasis I recalled all the abortive effort, the vain expense of strength, of the enterprise, now rapidly receding into the past, and wondered whether I regretted it; whether I would do it again were the chance to offer. Before I had considered it I knew that I would, knew that the experience was real, and that therefore I would always treasure it.

Others have achieved material results far greater, have made journeys more perilous and more spectacular. But no one, going forth in the spirit of adventure, has found more joy and delight in the fulfilment of his enterprise than I did in the failure of mine.

SAXTON'S SURVEY OF NORTHERN ENGLAND

GORDON MANLEY

MOST of our scanty knowledge of Christopher Saxton, the notable surveyor of Elizabeth's reign, is due to the investigations of the late Sir H. G. Fordham. We do not even know the exact date of his birth or death, or how he became a surveyor, or what methods he used. In particular we know very little about his most important work—the survey of England and Wales, which formed the basis for the series of thirty-four county maps published between 1574 and 1579. These in turn provided the greater part of the material for the topographical maps of this country for well over a hundred years.

Suggestions have been made with regard to his procedure, based on considerations of his errors in measurement and of the methods of survey known at the time and likely to be practised by a man working fairly quickly. These appear to point to a series of compass traverses as the basis of the survey over much of the country. There is only one hint to be got from documents of the time. This is found in the letter of instruction to authorities in Wales "to see him conducted unto any towre castle highe place or hill to view that countrey." Bearing this in mind, that at times he may have ascended hills for the view, it appeared to me that a careful inspection of Saxton's mapping of hilly country might afford some results of interest, and that the conclusions derived from his mapping of one region might be tested by applying them elsewhere. I was first led to consider the possibilities of this method of approach on examining the detail of the Pennines on the Durham sheet of 1576. With the aid of the Ordnance Survey maps and a personal knowledge of much of the country, some material has been gathered which may perhaps promise further results. In particular, some conclusions with regard to Saxton's procedure in the Pennines may be tested against his mapping of the Lake District with success.

Some of the more conspicuous insertions and omissions from his maps may be mentioned. Haweswater is altogether omitted and Esthwaite Water is shown only on the Cumberland sheet; and if it is argued that the scale of the maps precludes representation, why were Wastwater and even Devoke Water,

which is much smaller, clearly shown? The choice of Pennine hills selected for naming on the Durham sheet is also remarkable, as it includes an immense "Bauderskarth Hill" at a point just north of the Stainmore road where no large hill exists. There is also an enormous "Holwick Cragg" dominating Teesdale, which is in reality little more than the top of a rather steep scarp rising 400 feet above the valley.

The important Pennine hills named by Saxton

I. Historic.
II. River sources.
III. Beacons.
IV. Boundary-marks.
V. Saxton's ascents (?)

II.	"Kellop Law Hill"	Kilhope Law, 2208 feet. Source of Wear.
II. IV.	"Bauderskarth Hill"	? head of Baldersdale.
V.	"Holwick Cragg"	above Holwick, Teesdale.
?I. ?III.	"Morton Pike"	Murton Pike, 1950 feet. "Narrowgate Beacon" is not far away.
	"The Blake Lawes"	Not defined: towards head of Teesdale.
II.	"Huseat Moruell Hill"	Hugh Seat, 2257 feet (Eden, Swale, Ure).
III.	"Penhill Beacon"	Wensleydale, 1685 feet.
?I. ?V.	"Wharnside Hill"	Great Whernside, 2310 feet.
I.	"Pennyghent Hill"	Penyghent, 2373 feet.
II.	Cam Hill	Cam Fell (Ribble).
I.	Ingleboro Hill	Ingleborough, 2373 feet.
V.	Whelpstone Hill	Whelpstone Crag, 1216 feet, near Settle.
?III.	Pinnow Hill	Not on 6-inch map. Near Skipton, perhaps on Elslack Moor, 1274 feet.
II. ?IV.	Gorpill Hill	Gorple, near Burnley (only shown from Yorkshire side).
	Blakeston Edge	Blackstone Edge, not defined as one hill.
I. III.	Pendle Hill	Pendle, 1831 feet.
I.	Rivenpike Hill	Rivington Pike, 1191 feet (?Faierlokke, Leland).
III.	Longridge Hill	Longridge Fell, 1149 feet.
III.	"Clough ho Hill"	Clougha, *c.* 1000 feet, near Lancaster.
II.	"Wulfocrag"	Wolfhole Crag (Wyre; but Saxton makes the Calder rise here).
?V.	"Farleton Knot Hill"	Farleton Fell, *c.* 850 feet, south of Kendal.
II.	"Nowstoole Hill"	East side of Kinderscout, 2088 feet (Noe).
V.	"Urconedge Hill"	Not on 6-inch map. East of Hathersage, Derbyshire.
I.	"Manhill"	Mam Tor, 1700 feet.

On Saxton's maps, compared with those of the present day, noticeably few hills are named, at least in the Pennines. There are of course but few outstanding summits. A great many of the Pennine hills are named after the nearest farm or village, *e.g.* Dufton Fell, Fairsnape Fell; and the ill-defined boggy summit is simply known in the valley as "the top o' t' fell." The few

hills of especial prominence generally bear names of Celtic derivation, such as Pendle, and these are often associated in one way or another with local tradition. To this day in mid-Lancashire every one knows Pendle as a feature of the view from any hill, but scarcely any one can name the Bowland Fells. I have therefore classified a certain number of Saxton's hills as Historic (I).

A second class (II) comprises hills in which rivers take their rise. These too were no doubt important in local tradition, perhaps from pagan times; Leland frequently jotted down notes about them. It is evident from the maps that Saxton did not use Leland, at least in Northern England, but collected his own information on the ground; for example, Leland mentions a lake which is evidently Haweswater, which Saxton omits. But it is clear that Saxton paid attention in the same way to the importance of certain hills as river-sources, and Harrison makes several critical comparisons of Leland's accounts of river-sources with those of his "other writer." One of the most notable of this group (II) is "Huseat Moruell Hill" (Hugh Seat, 2257 feet)—as the source of Eden, Swale, and Ure. Several other hills in the above list explain themselves, *e.g.* "Nowstoole Hill"; "Noe Stool" forms the source of the river Noe on the east side of Kinderscout, above Edale in Derbyshire.

Class III comprises the beacon-hills. These were often not the highest summits, but of course had to be widely visible, *e.g.* Penhill Beacon (for Wensleydale), Whinfell Beacon above Kendal, and Clougha Hill near Lancaster. Saxton is not quite consistent with regard to these. Sometimes they are named, but without a beacon sign ("Clough ho Hill"). In two or three instances he draws a beacon but does not name the hill (Richmond, Yorks, and Orton, Westmorland), and sometimes both name and sign are found, as for Penhill (Wensleydale). There are also two instances at least of a conspicuous hill-drawing without a name, which on investigation prove to have been beacon-hills at this time. Both these hills—Warton Crag near Carnforth, and "Priso Hill" (Preesall) near Fleetwood—lie however outside the Pennines; they are shown as beacons on the MS. map of Lancashire (*c.* 1573) in Lord Burghley's copy of Saxton's atlas at the British Museum. It is clear then that Saxton paid attention to the beacon-hills, although it is not easy to suggest why he did not represent them all in the same fashion.

If we take Northern England as a whole there seems to be a fourth reason for Saxton's choice of hills: namely "prominent hills marking boundaries." This group (IV) is hardly represented in the Pennines; possibly the mysterious "Bauderskarth Hill" on Stainmore, already mentioned, was put in for this reason, as well as "Mole Cop" (Mow Cop) on the Staffordshire–Derbyshire boundary south of the Peak. I suggest this fourth class on account of the profusion of such hills along the Scottish Border: for example, the Cock Law, the Whele Fell, and others. Twenty hills are named in Northumberland of which only two are away from the Border or its neighbourhood, and I would suggest that these names were largely inserted to define the English boundary. Alternatively, this country was better known and named, both from the number of forays, and of traders and smugglers.

Saxton then had in mind several reasons for naming a certain number of hills on his maps. Judging by the drawings, the heights given to the hills were associated with their appearance to the eye. Ingleborough, for example, is one

of the highest hills; "Huseat Moruell Hill," which is much less bold if viewed from the east, is given about half the height. But some few hills are given an emphasis out of all proportion either to their actual height or to their appearance. The greatest of all the Yorkshire hills, if judged by the drawing on his map, is "Whelpstone Hill" south-west of Settle. Whelpstone Crag, as it is now called, is indeed a superb viewpoint over Craven and Bowland, but is only 1216 feet (Ingleborough 2373 feet). There are other hills which are similarly emphasized; one of these has already been mentioned, namely Holwick Crag above Teesdale. These hills, and others, form a fifth class (V), for their emphasis is difficult to explain on other grounds. Further, on investigation of the mapping of their surroundings according to Saxton's maps it would appear that these represent hills which he (or a "chief assistant") actually climbed. It is of course not impossible that he went up some of the others which I have called "historic" or "river-sources"; but in most cases it is unlikely judging by his mapping of the surroundings. The evidence points rather to his going no farther up valleys than he could help (*cf.* details of Weardale, Teesdale, Wensleydale, the Derwent valley in North Derbyshire, Bowland forest), and one may eliminate the great majority of the river-source hills on these grounds. Compare, for example, "Cam Hill" and the upper course of Dentdale as he maps it.

We may examine this group (V), beginning with Holwick Crag above Teesdale. In actual height, according to the scale of the maps, Saxton almost ranks it with Ingleborough; actually the top of the steep Whin Sill scarp (the "Crag") is only 300 or 400 feet above Holwick village; beyond this the moor rises gently westward. Now from an inspection of the map of Teesdale as drawn by Saxton, it seems clear that he looked up the valley from a convenient point, probably on the Yorkshire side; he put in the Eggleston streams, Hudesshope (named) with Middleton on it, two streams (Flushiemere Beck and Ettersgill) opposite Holwick, and Langdon Beck which he also names. An observer on the moor west of Holwick however is able to take the bearing of upper Teesdale for several miles to the north-west. At the same time he can take bearings of places (*e.g.* Newbiggin, Durtpit) on the opposite side of the river; and also he can place them in proper relation to the various streams—all of which Saxton appears to have done. If he had traversed the northern, or Durham side of the valley it seems most unlikely that he would have drawn so large an eminence opposite; and for a quick survey of the region he could hardly have chosen, or been led to, a better viewpoint than the moor above Holwick. Further we may observe that his placing of the county boundary is reasonably correct in relation to the Tees, but he shows no detail of either the Maize Beck or the uppermost 4 miles of the Tees itself—neither of which can be seen from this particular viewpoint, while either stream would scarcely have been omitted if Saxton had been to them. Indeed, it appears that the stream now named the Crook Burn may have been then regarded as the source, for Leland was informed thirty years earlier that the Tees rose in Yad Moss. This is the moor, crossed by the Alston road, where the Crook Burn rises: and from a point above Holwick the general appearance of the valley suggests that the Tees does rise from the valley of the Crook Burn. I have added a diagram to show the trend of these streams and other detail; we may presume that Saxton

received information locally with regard to the course of the boundary. From an analysis of his detail therefore, together with the arguments that may be brought against any other procedure, I suggest that the great prominence given by Saxton to Holwick Crag indicates that it was one of the (comparatively few) high points he visited, and that from it he took the general direction of the upper valley; he was also not far from the truth in his estimate of the distance to the head of the Langdon and Harwood valleys. This last perhaps

Fig. 1

he also learnt locally, just as Leland did earlier with regard to upper Weardale. I have endeavoured to show the results of this method in Fig. 1.

A second hill which it appears he ascended to save himself the trouble of going farther up remote valleys, is that which he calls "Urconedge Hill" in Derbyshire. Here again he gives it prominence, making it bigger than Mam Tor, 1700 feet, but smaller than "Nowstoole Hill" (Kinderscout above Edale, 2088 feet). It is placed just east of Bamford and Hathersage; and it is worth pointing out here that he is careful about the placing of Hathersage on

tributary stream just away from the Derwent, just as he is with regard to Middleton in Teesdale. On inspecting the 6-inch maps however I can find no trace of a name resembling Urconedge. But it may be observed that if he went up the hillside east of Hathersage he could get a general direction up the Derwent; he could see the Hope valley in its upper part with "Nowstoole Hill" even higher than he was himself. (Stanage Edge, which he perhaps reached, is 1400 to 1500 feet above the sea.) But his direction for the river Noe above Hope, and his placing of "Netherbooth" on its right bank, rather than on the left, make it clear that he did not enter Edale. In and about the upper Derwent valley he puts in a bridge (perhaps Ashopton Bridge), Woodland (which is a parish), Derwent Chapel, Newchapel, and Howden House; but, one may judge, all from hearsay. The distances are reasonable, but the river Ashop is entirely neglected and the Westend stream was perhaps then regarded as the head of the Derwent; the main source is omitted, judging from his position for Howden House. At the same time it is clear that he got good information regarding the county boundary, and made it run correctly from west of Lady Cross on the Manchester–Penistone road to a point on the Derwent south of Howden House; and later, well to the east of "Urconedge." From this and the range of his view he may have reached a point between 1 and 2 miles east or east-north-east of Hathersage.

We have then two hills, each providing good views which would save further journeying, and each well marked by Saxton; and there are others. Whelpstone Crag, south-west of Settle, is shown most prominently (despite its height of only 1216 feet) on his maps. It can easily be reached from the road between Settle and Bolton-by-Bowland, and commands a very fine view, down the upper Hodder valley in particular. His placing of Slaidburn however in relation to the bend of the Hodder rather suggests that he did not go down the valley, and this is perhaps borne out by the neglect of the Hodder valley below Newton—or of any of its tributaries, either on the Yorkshire or the Lancashire sheets. Further, one would imagine that he would have been tempted to avoid an extra journey down into this remote corner of Yorkshire—in any case sparsely inhabited. One is tempted to see signs of hurry in the omission of Edisford Bridge over the Ribble leading to Clitheroe, and Higher Hodder Bridge above Mitton, whereas he inserts the bridge at Gisburn. Further, if he surveyed one county at a time, as it appears he did, his natural route in this part of Yorkshire would have been from Settle to Rathmell, ascending Whelpstone Crag from here, then on down the Ribble valley on the Yorkshire side through the several villages he names. In this region the survey of Lancashire suggests that that county was surveyed after Yorkshire, although published in the same year (1577); if one may judge by the insertion of the bridges and the improved position for Radholme Park in relation to the county boundary and the Hodder. Similar comparisons may lead to some idea of the order in which Saxton surveyed the counties.

To return to Saxton's hills: it seems that of all those he named in North England he ascended very few. If, according to the evidence, it seems likely that he did ascend them, they are prominently shown, and do not fall under the other categories of river-sources, beacons, or "historic hills."

The Pennine valleys

It is clear from the maps that Saxton did not, as a rule, travel any farther up the valleys than appeared to him to be necessary. We have already seen that the head of Teesdale was not visited; similarly, in Weardale the three headstreams of the Wear are made to converge at St. John's Chapel. Actually, the confluence of two of the headstreams is 4 miles above, and the third comes in at Wearhead, 2 miles above St. John's Chapel. In Swaledale however the very good detail of Muker, Thwaite, and Keld suggests that this valley at least was traversed nearly to its head. In Wensleydale it is doubtful whether Saxton visited any point beyond Hawes or thereabouts; otherwise he could hardly have missed Widdale, and in particular the fact that there is an easy valley-route to the Eden. Nidderdale and Wharfedale are reasonably correct and may have been traversed nearly to their heads. On the west of the Pennines however, the length of Dentdale, the misplaced source of the Rawthey, and the detail of Bowland Forest all point to the conclusion that the uninhabited upper valleys were not visited. Their direction however is often very fair, and again one is led to the conclusion that he took a bearing of the general direction of the valley-head and either estimated its length, or took local information, *e.g.* for the distance of Lunds ("Helbeklunds") and other villages up the valley from Hawes.

It is not possible here to review every detail of the Pennines as shown on Saxton's maps. But although many points are open to discussion, the cumulative weight of the evidence indicates his practice. We may conclude that his methods were those of a surveyor working rapidly. He climbed very few hills; as a rule, only when it appeared to him that he could thereby save a further traverse into sparsely inhabited country. He was thus accustomed to put in detail by estimating distance along bearings from a single point. He was conscientious with regard to county boundaries and other detail in the cultivated lowlands, but wherever possible he avoided the trouble of going beyond the limits of habitation through country which he knew or thought to be uninhabited, especially if he was thereby led into another county.

For it is clear that he surveyed one county at a time; one of the few points where he crossed the uninhabited moors of the Pennine watershed was between Penrith and Alston, on his way to survey the outlying north-eastern part of Cumberland—if we may judge from the very reasonable distances and detail on the route between those two towns. Otherwise his performance suggests that he, like most of his contemporaries, was not interested in hills for their own sake; and that the few hills whose ascent he made were so much impressed on his mind that he exaggerated their importance on his maps.

Many of the details, and errors, of the Pennines and the Lake District may be explained on this assumption. I have added diagrams (Figs. 1 and 2) from which Saxton's procedure in Teesdale may to some degree be judged; also his survey of the outline of Windermere—which is given a different shape on the two maps on which it appears. Saxton most probably approached Windermere (on the Cumberland–Westmorland sheet) from the north or east. The detail around Ambleside is good, but Esthwaite, over the border in Lancashire, is made to have an outlet to the north rather than to the south; presumably being

in another county it was not visited, and the detail was put in by hearsay with some misunderstanding.

Belle Isle, and the bay near Calgarth, on the east shore north of Bowness, are omitted. It seems odd to find a large island like Belle Isle missing, for the three much smaller islands in Derwentwater are mapped very fairly. But such

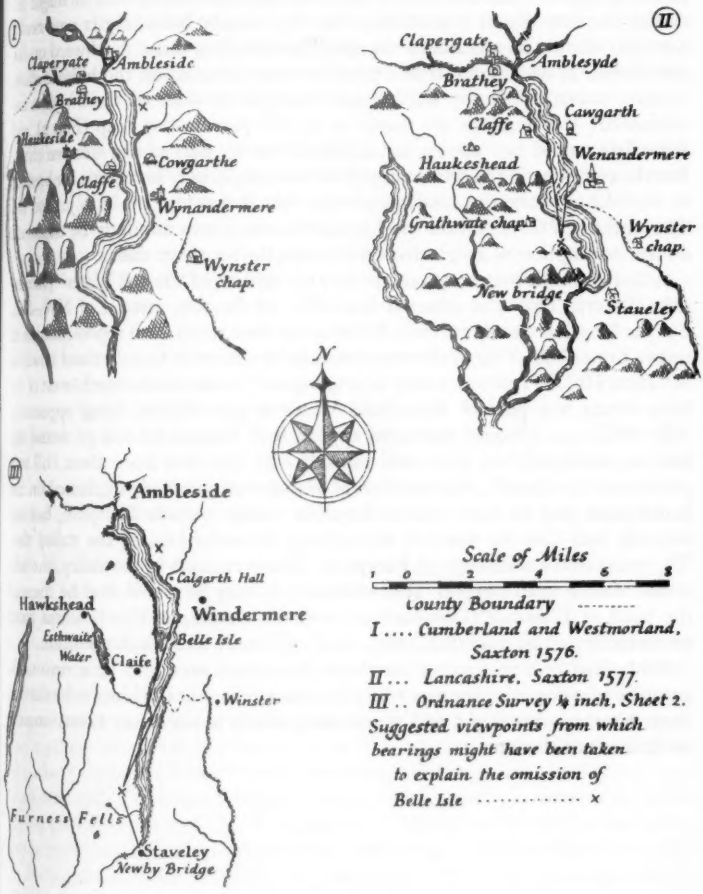


Fig. 2

an error would clearly arise if we assume an observer looking down the lake from a point about 3 miles south-south-east of Ambleside, quite near the road to Troutbeck Bridge (which is shown by Saxton) and Kendal. Further, the county boundary comes down to the east shore of the lake at about the right distance from Ambleside; but the detail of the shore is wrong; in fact, the whole south end of the lake was probably sketched in from a view near Calgarth

("Cowgarthe") and an assumption of its bearing and length based on local information. Comparing the outline on the Lancashire sheet we find a much better detail of the south end of the lake. Again however Belle Isle is missing and the curves of the lake for the first few miles northward are exaggerated. Esthwaite is quite omitted, and we may presume that Saxton never saw it or heard of it from that end of the lake, and perhaps overlooked or forgot his earlier map on which it is shown. But the county boundary is now nearly correctly shown in relation to the small peninsula 4 miles northward up the east shore. If we assume that a position was occupied on the hillside about 2 miles north of Newby Bridge and west of the lake all these points are explained; the bearings are nearly as on the present-day map (Fig. 2), and Belle Isle would not appear as an island but as part of the western shore. But the errors lay in the estimating of distance, especially as regards the breadth of the lake opposite the small peninsula, which was also made to jut too far. The outline of Coniston on the Lancashire sheet may similarly be explained on the assumption of a sight from very near the southern end.

A final example may be given, namely the outline of "Broad Water" (Ennerdale Water). This was oriented NE.–SW. by Saxton, instead of NW.–SE., but the length is nearly correct. At the same time there is no representation of upper Ennerdale. One of the very few hills he shows in Cumberland however is "Dent Hill," 1131 feet, a very fine viewpoint 3 miles to the south-west of the lake. From it a part of Ennerdale Water is just visible, lying apparently NE.–SW., and it would therefore appear that Saxton did not go round the lake in any detail, but contented himself with the view from Dent Hill or a point near by. Lastly, his omission of Haweswater is easily explained on the assumption that he went up the Lowther valley towards Bampton, but not beyond, and that he was not told of any place farther up the valley than Thornthwaite, a mile beyond Bampton. If one remains in the valley, the lake is not visible until beyond Thornthwaite. It may be noted that he mapped the head of Wastdale (Cumberland) with its chapel, so that it seems more remarkable that he missed Mardale with its church in a similar position.

With further investigation on these lines there seems to be a reasonable promise of more evidence regarding his procedure, but the hints to be derived from his maps are slight and much comparison is necessary before coming to further conclusions.

THE FIRST SIGHTING OF AUSTRALIA BY THE ENGLISH

IDA LEE

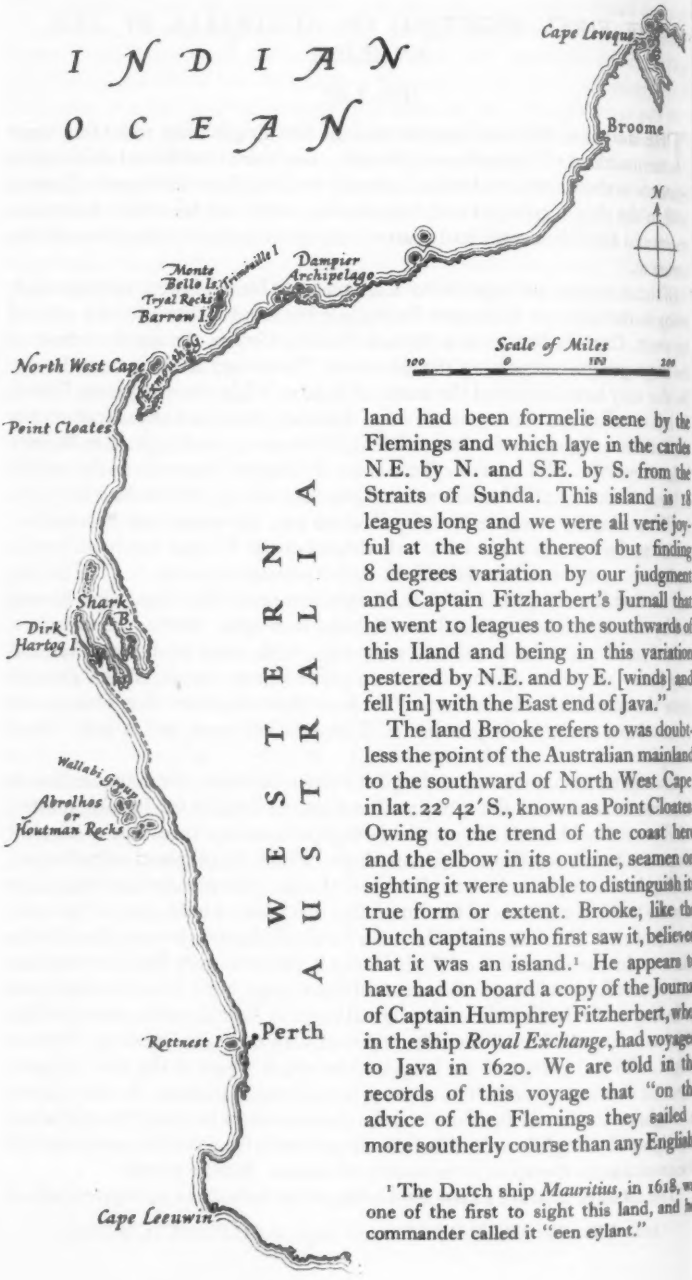
THE story that William Dampier was the first Englishman to set foot upon the mainland of Australia may be true. But there is sufficient evidence in existence to show that long before Dampier doubled Cape Lévêque in January 1688 in the ship *Cygnet*, of London, English ships had traversed Australian waters and English seamen had charted islands lying close to the shores of the continent.

Of these voyages perhaps that of Captain John Daniel is best remembered, owing to the fact that Alexander Dalrymple has handed down to us a copy of his chart. Captain Daniel first sighted Wallabi Group, the northernmost of the three groups comprising the Abrolhos. He named it Dangerous Rocks. He also may have bestowed the name of Maiden's Isle upon Rottnest Island, for it is so called upon many an old map. His ship, the *New London* (not simply the *London*, as her name is often written), of 600 tons, was freighted to Bantam in January 1681. She arrived off the coast of Western Australia in the month of June, when Captain Daniel's printed journal records: "With the wind S.W. by W. steering by compass N.E. by E. at 10 a.m. the water was discoloured. A man at the foretop saw a breach rise ahead of us. We put our helm hard a starboard . . . and weathered the N.W. end of it about ½ a mile. . . . The breach that we first saw happened to be the northernmost of all, there being several and by our computation [they] are 20 miles in length. Within the breaches, several small white sandy islands were seen, with some bushes on them. A very heavy sea broke against the south part of these shoals. When close to them the mainland was not seen." It is evident therefore that Daniel was aware of the mainland's proximity. This was six years and a half before Dampier reached the north-west coast.

At a still earlier date however English vessels had made their appearance in these southern waters. On 4 September 1621 the *Trial* (John Brooke, master) left Plymouth with a full cargo and 143 men on board for Java. She made slow progress towards the Cape of Good Hope, where she obtained refreshment, leaving there on 19 March 1622. Two months later she was wrecked on a ledge of rocks to the north-west of the Australian continent, where many of her crew were drowned. From that time the rocks on which she struck were placed in the charts under the name of the "Tryal Rocks." Hitherto very little information has been available relating to the events of this voyage, but I have been fortunate in finding at the India Office the original letter of Brooke to the owners of the *Trial* narrating the loss of the ship, together with another written by Thomas Bright, who had charge of the long-boat in which a part of the crew escaped from the doomed vessel.[1] These are of considerable interest, for they throw new light on the fate of the *Trial* and the circumstances in which Australia was first sighted by Englishmen. The following extracts from the above-mentioned documents seem therefore to be worthy of record. Brooke writes:

"The 1st daye of Maye I sawe land being in the latitude of 22 degrees, which

[1] India Office Records, O.C., vol. ix, no. 1072, and O.C., vol. ix, no. 1070.



land had been formelie seene by the Flemings and which laye in the cardes N.E. by N. and S.E. by S. from the Straits of Sunda. This island is 18 leagues long and we were all verie joyful at the sight thereof but finding 8 degrees variation by our judgment and Captain Fitzharbert's Jurnall that he went 10 leagues to the southwards of this Iland and being in this variation pestered by N.E. and by E. [winds] and fell [in] with the East end of Java."

The land Brooke refers to was doubtless the point of the Australian mainland to the southward of North West Cape, in lat. 22° 42′ S., known as Point Cloates. Owing to the trend of the coast here and the elbow in its outline, seamen on sighting it were unable to distinguish its true form or extent. Brooke, like the Dutch captains who first saw it, believed that it was an island.[1] He appears to have had on board a copy of the Journal of Captain Humphrey Fitzherbert, who, in the ship *Royal Exchange*, had voyaged to Java in 1620. We are told in the records of this voyage that "on the advice of the Flemings they sailed a more southerly course than any English-

[1] The Dutch ship *Mauritius*, in 1618, was one of the first to sight this land, and her commander called it "een eylant."

man had gone before, which proved very healthful to the men."[1] The *Royal Exchange* therefore had preceded the *Trial* into these waters, but in the accounts of Fitzherbert's voyage there is no mention that he sighted any land in this locality.

Brooke experienced a long delay after weathering North West Cape. He continues: "I take the opinion and counsell of my people when the winds came faire but havinge contrarie winde betwene the N. and the N.E. which held us from the 5th daye of Maie untill the 24th of the same month, the great Iland with his 3 small Ilands at the Easter end bearing S.E. 20 leagues of us[2]; the winde veering to the S.E. and faire weather, we steered N.E. thinking to fall [in] with the wester part of Java. The 25th daye at 11 of the clocke in the night—faire weather and smoothe watter—the shipp strooke. I ran to the Poope and hove the leads. I found but 3 fadom watter, 60 men being upon the deck, 5 of them would not beleave that she strooke, I criinge to them to beare up and tacke to the westward: they did ther beste but the rock being sharpe the ship was presentlie full of watter. For the most part of these rocks lie 2 fadom under watter. It struck my men in such a mayze when I said . . . the ship strooke and they could see neyther breach, land, rocks, chainge of watter nor signe of dainger,—the ship sitting a good while after that I had hove the lead whilst I had brought my sailes a backstaies. Before she strooke the second strooke the winde began suddenly to freshe and blowe. I strooke down my sailes and gott out my skiffe and bid them sound about the shipp. They found sharp suncken rocks half a cable in length astarne, noe ground. These rocks are steepe to, so I made all the waye I could to gett out my long boate and by 2 of the clocke had gotten her out, and hanged her in the tackles over the side. Soe seeing the shipp full of watter and the winde to increase made all the meanes I could to save . . . as manie . . . as I could. . . . The boate put off at 4 in the morning and halfe an houer after the fore part of the shipp fell in pieces! ten men were saved in the skiffe[3] and 36 in the long boate . . . I came awaie with my boate for the Straights.[4] My boate [*i.e.* the long-boat] stood back for the great Iland [presumably Barrow Island] which is 7 leagues to the S.E. wards of the place where the shipp was cast awaie."

Brooke now gives a piece of information regarding a discovery made by the long-boat which by reason of its early date ought to provide a new starting-point for historians recording English explorations of Australia. He says: "the boate found a little lowe Iland . . . I fell [in] with the Easter end of Java the 8th daie of June 1622: at Bantam the 21 ditto and at Jaccatra [Batavia] the 25th of the same month. I had one barrecoe of watter, 2 casses of bottles, 2 runlets of aquavite, 40 li bread and for 4 daies togeather so much raine and sea that our skiffe was allwaies $^1/_3$ full of watter. The boate had 2 runlets wine, 6 barrecoes of watter, 2 casses of bottles and 1 C′ [wt] of bread." In describing the approach to the Tryal Rocks, he remarks: "This Iland lieth false in his Longitud 200 leagues [sic] . . . as also these suncken rockes as by my draught

[1] Extract of a letter from Launcelot Fenwicke to the E.I. Company, India Office Records, O.C., vol. vii, no. 919.

[2] Barrow Island.

[3] Brooke himself was saved on board the skiff.

[4] He probably passed through Bali Strait on his way to Bantam.

will appear. . . . A Dutch shipp the *Armes of Horne*[1] which came some month after me fell [in] with the land. . . . This remote passidge the Dutch Generall doth not like, such over falles, weeds and ripplins which I and this Dutchman have passed! . . . and noe ground at 200 faudoms but in stormie weather in the night in some places, the sea is all in a breach."

The fortunes of those who left the ship in the long-boat are vividly described by Thomas Bright, who had charge of her. He writes: "May the 25th about X of the clock, night and fayre weather . . . in Lattitude 20° 3′[2] . . . shipp . . . struck upon the rocks as soon, or before any breach discovered; billidged her hould full of watter in an instant. . . . The long Boat with greatt difficultie wee gott out [there] being 128 soules left to God's mercye, whereof 36 [were] saved. Wee keeping till day some ¼ mile or more from the shipp . . . the sea then so high, wee durst not . . . adventure to them and for that wee [were] so slenderly provided with provisions that [it was] impossible, without God's great providence, wee should aryve at our wished [for] port. . . . Upon night of day wee espied a Iland bearing South East some five leagues att most from us. . . . By all likly hoods land could not be farr by the fowle and weeds all that day drivinge from the Iland and rocks, to which said Iland wee went; stayed thereon seaven dayes for the freinge [freshing] of our boate and supplie of watter (having when we left the shipp but one barrecoe full, the reste emptie [there] being none but what the Lord sent per rayne). Not any inhabitants thereon. Wee travelled over all the Iland seeing nothing but Ilands, some small, some greatt, breaches and shoules every way as farr as wee could see. Very dangerous on the N.W. syde. To the S.S.W. of this Ile ther lyeth a great Iland[3] neere nyne leagues off." The men therefore spent a week on the "little lowe iland" which Brooke has already told us his boat "found." He made 2 "draughts" of the "rocks and Iland with their Latituds, Longituds, variations, courses and distances" seen in the vicinity which were sent home by "first conveyance." Bright also says he intended to "laye downe a full description of these Ilands." Their charts evidently arrived safely in England but do not seem to have been preserved and the situation of the rocks whereon the *Trial* struck remained a secret for many years. Both English and Dutch ships searched for them until many began to doubt their existence, because the seamen who claimed to have sighted them placed them in different latitudes. Dampier hoped to find them. The *Jane* frigate in 1705 looked for them in vain. In July 1777, Captain Martin Foss, of the ship *Fredensberg Castle*, reported that he had seen them. This Danish account stated that they "bore E. distant 12 miles at noon in lat. 20° 40′ S. meridian distance 23° 45′ E. from St. Paul" and that "these rocks lie N.W. and S.E. and extend in length 24 miles, the centre of them appears . . . not higher out of the water than a small vessel's hull: the extremes are clusters of small broken rocks now and then appearing as the sea retires and are about 4 miles from each extreme of the main rock."[4]

[1] The *Wapen Van Hoorn* sailed from the Texel 22 December 1621, and arrived at Batavia 22 July 1622.

[2] Brooke gives the latitude as 20° 10′ S., and he so reported it to the Dutch Governor-General when he arrived at Jacatra.

[3] Presumably Barrow Island, to which Brooke has already drawn attention in his letter.

[4] Captain Stokes afterwards recognized them by this description, although he found that Foss's longitude "placed them 13 degrees more to westward, near the position they have occupied for years in the charts" (Stokes's 'Voyage in the *Beagle*,' vol. ii, p. 209).

Captain Wilson, in the *Vansittart* in 1789, was the next who endeavoured to locate them, and began his search where they had been placed by the Danish captain; but he did not find them, and therefore concluded that if the rocks Captain Foss described "were situated within these limits" it was barely possible that the ships *Lascelles*, *Carnatic*, and the *Vansittart* "could have passed without seeing them." Once again the sea kept its secret, and on hearing the result Horsburgh was led to remark: "We are still left in doubt whether or not the Tryal Rocks . . . have any real existence." Geographers however continued to place them on their maps, even after sailors had given up the search as fruitless.

At last, in 1819, the voyage of the *Greyhound* on her passage from China to Port Jackson reopened the question, her Commander declaring that he had met with a reef of rocks which were the long-lost Tryal Rocks. In 1820, acting under orders from the Admiralty, Lieutenant Phillip Parker King, in H.M.S. *Mermaid*, made a minute survey of the different situations where the rocks had been reported and came to the conclusion that the Monte Bello Islands exactly answered their description, and he writes: "There remains no doubt in my mind but that Barrow Island in 20° 40′ S., 115° 27′ E. and Trimouille Island and the numerous reefs around them, are the identical Tryal Rocks." Since King's day naval surveyors have found their exact position. Admiralty Sailing Directions (1917) states: "Tryal Rocks awash at high water are near the outer edge of the S.W. part of Monte Bello Islands reef and 5 miles N. of the North extreme of Barrow Island."

It is now difficult to realize that only seventeen years after Willem Jansz, in the Dutch ship *Duifken*, had made what is known as "the first authentic discovery of Australia" thirty-six shipwrecked English seamen spent seven days almost within sight of the land which afterwards was proclaimed a British possession and became the home of so many of their race.

MOVING SWAMPS IN CEYLON

W. G. ADAM, Hon. Game Warden, Horton Plains Hunting Reserve

THE swampy portions of the up-country moorlands of Ceylon are constantly altering in contour. The soil of these moorlands is of a fine, black variety some 2 or 3 feet deep, covering a substratum of reddish stony earth. Upon sloping, waterless land this black soil cakes into almost unworkable hardness, for it allows no drainage through it. It gradually wets through from the top in continuous rain, when, should it happen to be exposed to however light traffic, it becomes a deep morass of particularly objectionable mud. In the swamps this black earth grows a type of coarse, reedy grass, which harbours much water at its roots, and this surcharge of moisture, aided by the top-weight of grass, causes the soil of a sloping swamp, even on a slight gradient, to slide slowly downwards in the form of what may be called a "Mud Glacier."

Not only do such swamps move down a slope, but to right or left across it, while at times they heap themselves up into mounds of particularly treacherous

ground, presumably owing to extra local pressure of water which cannot escape, and occasionally fall into little valleys where drainage happens to be more convenient.

I first noted the mobility of these swamps at an elevation of 6226 feet in June 1927. A path running through a boggy patch, about 100 yards in length and originally with an obvious convexity to the north, seemed to run plainly due east and west in an almost straight line. The gutters at each side and the path itself were in good order, showing that the whole of the upper earth had moved *en bloc*. Previously there had been a gradually sloping swamp extending to some jungle above, but at that date the land for some 50 feet from the jungle edge was dry and hard, while, just above the path, the swamp had heaped itself into a boggy hummock some 10 yards long by 7 wide.

Two years later the hummock had flattened itself out towards the path, which last appeared to have risen about a foot in level for the whole central portion of its length. Again, below the path, where the valley had sloped away, giving a clear view of somewhat lower land, a great whale-back of reed-covered bog hid nearly everything but itself.

In March 1931 the movement of this swamp became so evident that I marked trees on either side of it, on firm land, and embedded a flat stone in the middle of the bog in a straight line between the trees. I took levels along this line, the marks on the trees reading each 30 inches from the ground, and the flat stone 48 inches below the ground-level at the tree bases. In April of the following year I re-examined the position. The flat stone had moved down the valley 6 feet roughly, and had risen 5 feet 1 inch. On 5 May 1933 I went over the levels and measurements again. The stone had moved a further 11 feet downwards, 4 feet to the west, and had risen another 1 foot 1 inch. This gives a total movement of the swamp of 17 feet down the incline in two years, with a puffing up of the surface of 10 feet 2 inches. (Plate 1.)

Knowing that similar instances must be taking place in other swamps, I picked a muddy little ravine at haphazard in 1931, and set up marks at either side with a stone in the centre, all in line as in the case of the other bog. Twelve months later I found that the stone had changed its position to 7 feet 4 inches lower down the slope, and had become raised 10 feet 6 inches above its original level. On making new measurements this year I noted a further 4 feet 6 inches of downward movement, while the level of the stone had sunk 9 inches below last year's height. (Plate 2.)

In neither of the above-mentioned cases is there the least chance of the stones or marks having been moved by man or animal, nor could the stones, being bedded amongst the grass stems, have had their positions changed other than by the whole surface of the swamps moving. The swamps are in sequestered spots where human interference is out of the question.

A greater alteration in the lie of land, though unmeasured, was noticed by myself and others in January 1930, when passing along a path in another part of the country. Previously the path had been dry and level, but then it was clearly seen that at two points some 100 feet apart, little bogs had begun to appear, while there seemed to be a slight hollow on the harder ground between them. In 1932 this alteration in the land was more definitely pronounced. The bogs were nearly impassable and had become raised up 3 or 4 feet. The

Plate 1

Plate 2

The camera is set up approximately on the original line of 1931 (here marked by three flags); the positions of the stones at the observations of 1932 and 1933 are marked by flags to the left

portion of path between them was more or less under water, but there was very little in the way of mud on its harder earth. My last visit to the spot was just after the abnormal rain of January 1933. Whale-backs of stiff bog had enclosed the central few yards into a regular little valley some 9 feet deep, which at last is becoming a morass, though, the soil being more drainable in consistency, there were signs of the beginning of a small stream.

THE *CARTE DU MONDE AU MILLIONIÈME*

COLONEL SIR CHARLES CLOSE

TWENTY years have passed since the International Conference on the Carte du Monde met at Paris and passed its unanimous resolutions, and we may now conveniently take stock of the results of this international effort. And, in taking stock, we shall not be likely to forget that the War and its aftermath had a generally depressing effect upon all international schemes, though in one respect it provided a stimulus.

A study of the Reports issued by the Central Bureau for 1931 and 1932 gives good ground for hoping that this excellent undertaking will be completed, at least as regards three continents, in a reasonable period of time. For if we include not only those sheets which are in strict conformity with the official resolutions, but also those which, though on the same scale and bounded by the correct sheet-lines, differ in other particulars from the standard, we shall find that Europe is practically covered, and Africa and South America are more than half covered, with sheets of the series.

The empty spaces are chiefly North America, Northern Asia, and Australia, though even in these areas a few sheets are available. Or, to look at the matter from another point of view, out of the total number of 840 sheets which will cover the land surface of the globe, somewhat more than 300 have been completed in one form or another, and this number covers some of the most densely inhabited parts of the Earth, such as Europe and India, whilst the remaining areas include the inhospitable polar regions. Of the 300 completed sheets, more than 200 conform, with some degree of strictness, with the official standard.

Amongst the more important blocks of sheets may be mentioned those which cover Western Europe (except southern Portugal); a block including Lower Egypt, Mesopotamia, and Northern Arabia; a magnificent block of 21 sheets covering the Indian Empire (except northern Burma); one including Siam and Indo-China; and an immense block covering Brazil.

Of sheets published according to the official resolutions during the past few years may be mentioned 4 of Egypt, 2 of Norway, 1 of New Zealand, 5 of Australia, and some interesting sheets issued by the American Geographical Society of areas in Mexico and South America. There were in hand 2 new sheets of Romania, 3 of Egypt, 3 of the Dutch East Indies, 1 of Siam, and no doubt there are others. Eleven new sheets made their appearance in 1932. Little by little the world is being mapped on this uniform scale, and we may

hope that the most important blank space, namely North America, may one of these days be taken in hand by the countries concerned.

These reports show how wise was the Paris Conference to advocate the establishment of a Central Bureau for the World Map. The functions of this Bureau are, according to the original resolution, now twenty years old, the publication of an annual report; the organization of a service of exchange of information; and the distribution to the adhering States of copies of all the sheets, as they are published. The Bureau carries out these useful functions very efficiently. The Central Bureau is the Ordnance Survey Office at Southampton, and the "Auxiliary Office" is the Royal Geographical Society.

The Report for 1932 justly remarks that "The production of special sheets of the International Million type, but bounded by sheet-lines most suitable for the assembly and production of national data, is a point which should be kept well in mind. The eight international sheets covering Great Britain have now been compiled into two larger sheets which will shortly be distributed to all adhering countries, and it is hoped that this example, together with that provided by the single sheet covering Denmark, will serve to emphasize this further application of the existing material." In all these matters, and in small cartographic details, like the use of black or brown contours, the Central Bureau will, no doubt, use the excellent rule of keeping the mean between the two extremes, of too much stiffness in refusing, and of too much easiness in admitting any variation.

The International Map is of more than cartographic value; it serves as a uniform basis for technical maps of a great variety of kinds. Thus it will serve as an admirable foundation for population maps. We have an example of this use in the new Population Map of Great Britain, northern half, recently published by the Ordnance Survey. Then it has been used to show the magnetic variation over the British Isles; the results of the Gravity Survey will be shown on this scale, and it has formed the basis of the Ordnance Map of Roman Britain and of the Map of XVII Century England. Its most striking, international, technical use is its application to the Map of the Roman Empire which is being produced by agreement between the authorities of France, Germany, Great Britain, Italy, Portugal, and Spain. Six sheets of this special series are in hand. At the invitation of the Italian Government a Conference was held in Rome in November 1932, which was attended by delegates of all the countries above mentioned. A unanimous agreement was arrived at as to the lines on which the work should proceed.

Those Fellows of the Society who are interested in the matter can see the published sheets of the International Map at the House of the Society, where the complete series is kept. As already mentioned, the Society is the Auxiliary Office of the undertaking.

REVIEWS

EUROPE

THE WOODLANDS AND MARSHLANDS OF ENGLAND. By H. A. Wilcox (Mrs. G. S. Treleaven). *Liverpool: University Press; London: Hodder and Stoughton* 1933. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 56 pages; maps. 6s*

In their efforts to reconstruct the physical and human geography of England in the past historical geographers have for some time emphasized the need for maps showing the woodlands and marshlands as they formerly existed, although they have been clearly aware of the very real difficulties which stood in the way of work of this kind. Miss Wilcox's work comprises two large folding maps and some forty odd pages of text, and was undertaken under the direction of a sub-committee—the membership of which is not disclosed—appointed by the Geography and Botany sections of the British Association. The maps are contoured 1 : 1,000,000 O.S. sheets; the one attempts to show the prehistoric condition of woodland and marshland at about the beginning of the Bronze Age, while the other shows a similar distribution as deduced from "early literature." In the former map an effort is made to differentiate between the relative densities of different forested areas by the arrangement of dots, which carry however no precise quantitative significance.

The work represents an attack on an exceedingly knotty problem, and its publication was worth while as affording a basis for discussion and further work. Nevertheless, it contains serious errors of fact and interpretation, and its standard falls measurably below what might have been hoped for in an officially sponsored publication in this field. There are various geological mistakes: for instance, reference is made (p. 24) to Millstone Grit and Old Red Sandstone in Devon and (p. 33) to Upper Greensand in Cambridgeshire, although none of these formations exists in the areas named. The text seems to imply (p. 15) that no information on the distribution of "drift" is available west of the margin of the $\frac{1}{4}$-inch drift sheets of eastern England. Actually, the drift sheets are available for much of the area. In particular, the Clay-with-Flints cover on the Chalk has been almost completely mapped in the south of England, and there is thus no excuse for treating this area as open downland pending the location of the clay patches (p. 12). In general, the geological errors appear to have arisen through the use of maps of too small a scale. On the small-scale map of England the Culm Measures of Devon are admittedly shown in the same colour as the Millstone Grit, but this is no reason for confounding in an ecological study two such contrasted formations. Further, several references treat soil and drift as if they were synonymous terms, and, needless to say, no pedologist would treat drift deposits as themselves soils in the scientific sense of the term. Certainly the results appear to be more acceptable for the north of the country than for the south; in the south there are many anomalies on the Chalk lands, and there seems to be no reason why the forests of the Weald Clay should be represented as much denser than those of the other clay lands.

The historical map depends on sources which a historian would hardly call "early." They begin with Saxton's county maps and cover the period down to the end of the nineteenth century. The evidence, derived from maps and literature, is very mixed both in date and in quality, but it has all been thrown into the bag with a marked catholicity which does not differentiate critically its varied validity. The resultant map is not destitute of interest and value although, since the several authors to some extent undoubtedly copied each other, the

method begs the question. Leaving aside the many limitations and defects of the evidence, the distribution is not true of any point or period of time; not only has it all the shortcomings of a map of mean climatic data, but it lacks some at least of its advantages.

W. G. E.
S. W. W.

MANOR LIFE IN OLD FRANCE: from the journal of the Sire de Gouberville for the years 1549–1562. By KATHARINE FEDDEN. *New York: Columbia University Press* (*London: Humphrey Milford*) 1933. 9×6 *inches;* xvi+228 *pages; illustrations and sketch-map.* 15*s*

We think of merry England in the sixteenth century but are apt to forget that there was also a merry France, though the merriment there ended abruptly with the coming of the religious wars in the second half of that century. The journal of the Sire de Gouberville for the years 1549–62 illustrates both the placid life of a country gentleman of the Cotentin in the good old days and the pitiful change to alarm and insecurity brought by the presence of three warring parties in the Peninsula. We have in this book not the journal itself nor a translation of it, but a charming reconstruction of life in a Norman manor based on the journal and on more or less contemporary works like Estienne's 'L'Agriculture et la Maison Rustique' of 1564. It is a pity that in the ground plan of a manor house constructed from Estienne's description the points of the compass are not only impossible in themselves but disagree entirely with Estienne's. This defect should be remedied in a future edition of a book on which a great deal of careful research has been expended. The noble and very human figure of the Sire dominates the whole; the delightful excerpts (in English) from the journal reveal the careful husbandry, simple tastes, and generous instincts of a most lovable character.

J. H. R.

PAVEMENTS AND PEAKS: impressions of travel in Germany and Austria. By ANTHONY BERTRAM. *London: Chapman and Hall* 1933. 7½×5 *inches;* viii+264 *pages; illustrations.* 7*s* 6*d*

Mr. Bertram makes no high claim for this book of travel impressions, confessing that he has nothing to say "about dates and the times of trains or the statistics of infant mortality in Upper Silesia." Nevertheless, though much of the book consists of slight incidents and personal reactions, there are passages of more than ephemeral interest. He visited Germany before the recent political developments upon which, wisely enough, he abstains from commenting, and singles out two subjects for discussion and approval—modern architecture and the physical culture movement. His main argument may be summed up in the tag "Efficiency is Beauty." It is a pity that he should have felt it necessary to make so many slighting references to his own country.

The section on Austria deals with his apprenticeship as a climber. The mountains evidently inspired him with reverence and a sense of proportion. The book gives the effect of a long and animated monologue with occasional prosy interludes, by a good talker, eager to air his opinions. It has therefore more power to hold the reader's attention than most books of this type.

G. R. C.

LES MODES DE VIE DANS LES PYRÉNÉES ATLANTIQUES ORIENTALES. By TH. LEFEBVRE. *Paris: Armand Colin* 1933. 10×6½ *inches;* 778 *pages; illustrations and maps.* 90 *fr*

This book, as the author points out in his introduction, is not a complete geographical account of the area treated, which—though the reader may not suspect it from the title—includes the whole of the Basque country. It is not even a

complete statement of the human geography, although it is less certain that the author himself fully realizes this. Since *modes de vie* means really, not "modes of life," but methods of gaining a livelihood, the subject is essentially economic; its economic character however is somewhat masked by the scope of the author's treatment. The reader who finds that the preliminary description of the *milieu physique* is written both on the scale and, apparently, from the independent standpoint of a separate work may well be pardoned for forgetting this; and one suspects that this description, which is clearly written and very skilfully illustrated, and which sheds a flood of light on districts not similarly treated elsewhere, will be used widely for purposes for which it was not intended.

M. Lefebvre himself realizes, doubtless, that his account and sections illustrative of the geological structure are very greatly simplified, and that he has not exhausted the literature, for the Spanish side at least. On the southern margin, for example, he has not considered either the sections given by Palacios in 1919 for the Sierra de Codés, or Schriel's sections published in 1930 for the Montes Obarenes, with the proposed solution of the problem of the gorges on the Ebro and its affluents. If he had avoided, for this marginal zone at least, precisions such as "structural surfaces dating from the Miocene," he would have been less likely to mislead the morphologist, and he would have sacrificed nothing relevant to his subject, which demanded a lithological map rather than a morphological. The morphology ought to be read merely as a praiseworthy attempt to give a generalized statement of the relief in the absence of a contoured topographical map, and, as such, it is excellent; but the labels are premature.

In the central sections of his work there is again much excellent matter descriptive of the *modes de vie*, past and present. In particular, the treatment of the pastoral life and industry seems to the reviewer wholly admirable and based on intimate personal knowledge. But both these and the closing sections, in which he discusses the influence of the *modes de vie* in the spheres of habitat, property, and the like, in which the range of possible influences is very wide, are accompanied by interpretative matter which either depends on, or leads up to, the main thesis; and in this there lurks a mischievous fallacy.

If the author's aim had been only to justify his subject by showing how important the considerations of economic function and convenience are in human geography, one would have said merely that he had overstressed a point which has been too often neglected. It was, for example, a defect in Urabayen's two studies of the Navarrese house (neither of which, by the way, appears in the bibliography of the present work) that the houses were seen almost wholly from the outside. But the author goes much farther, and his thesis, although it is not stated as explicitly as it might be, but has to be pieced together from detached statements, may be fairly said to be this: Men are not free, they have merely "the illusion of freedom"; the real controlling agencies are the *modes de vie;* true, these are not static, for new *modes* may appear as the result of borrowing or of historical impact, but (at least when equilibrium is restored) the *modes* must find themselves in harmony both with the *milieu physique* and with the *passé humain toujours présent*. Since this provides both for the historical method of transmission of culture and for the ethnic factor, which may be deemed latent in the *passé humain*, it might be thought that the controlling agencies were of a dual nature; but not so; for, as we are told, when we compare the distribution of the *modes* with that of ethnic characters and characters of the *milieu physique* respectively, we find no correspondence in the first case and perfect correspondence in the second. So that the *modes* are really agencies through which external Nature operates. Man is in effect the slave of Nature under his own methods as overseer—a doctrine which might be entitled Economic Methodism.

Direct control by Nature does not seem to be entirely excluded, but the whole bias is towards indirect physical control through economic function.

To arrive at this position, M. Lefebvre has of course to force facts. In the first place he either ignores or minimizes the significance of everything which might be taken as specifically Basque, and, in particular, the significance of the two-piece, double-pronged implement used as a foot-plough in the Basque country under the name of *laya*. In the teeth of all the evidence and against all human probability, he suggests that the *laya* is of Peruvian origin and links it up with the maize, with which he conjectures that it came to Europe, as the expression of a *mode de vie agricole fondé sur le maïs*. But against this theory are the awkward facts that the association of the *laya* in Spain is with the Basques, not with maize; within the Basque country it is not confined to the maize-growing districts, and, outside the Basque country it is not used at all, in maize-growing districts or elsewhere. It has no special affinity with any of the American digging- or planting-sticks, Peruvian or otherwise; on the contrary, it has some European affinities, and it is probable that classical scholars, when they consider the matter, will accept Aranzadi's suggestion that it is a survival of the *bipalium*.

Again, M. Lefebvre's argument from the correspondence of distributions is fallacious. If a geographical criterion is chosen for the subdivisions of the general category *mode de vie agricole* into the Mediterranean, sub-Mediterranean, and other types, the respective distributions will, by definition, correspond with those of physical geography, and it is not surprising that they should not correspond with those of ethnic and other characters, since there are no grounds for supposing that the boundaries of distribution of variable characters fluctuate *pari passu*, however closely they may have been associated originally. The test is not valid; and further it is obvious that, if the types of the general category had been chosen on a cultural basis, the agricultural *mode* based on the *laya* being one, the boundary of distribution of this type would have cut across the physical boundaries, so that one could have said, with equal justice or more, that *les facteurs physiques n'y interviennent pour rien*.

But M. Lefebvre is weak and his system of classification inadequate on the side of culture, though the detailed study of the material culture would appear to be germane to his subject and vital to his text. He uses the term *araire*, for instance, to cover both the four-sided plough which intrudes into the *laya* zone from the north and the crooked-beam plough which comes up to that zone on the south; and fails to recognize that the Basque country, besides including a unique cultural zone, lies on a great divide between a transitional northern culture and a Mediterranean; a fact which is independent of any distinction drawn from agricultural geography between mainly maize-growing and mainly wheat-growing districts, for example. This failure underlies what he has to say about square fields and convenience in ploughing and his criticism of M. Bloch. He did not see that in the south of his area convenience demands square fields, since cross-ploughing is the common practice (as he noticed), and cross-ploughing becomes more and more intolerable the longer the field. The association which M. Bloch invoked between Mediterranean ploughs and square fields is therefore real and, on a broad view, primary, without prejudice to the fact that square fields may originate in other ways. Whatever be the merits of M. Bloch's argument about the transference of the association to France, and of his reference to races in this context, M. Lefebvre makes unfair play with it, not reducing it to an absurdity, but merely applying it absurdly.

To sum up, in a just view this book must be looked on as an immense storehouse of facts which does honour to its author's versatility as an observer and to his perseverance as an investigator, in face of a task and of difficulties whose

magnitude the present reviewer is well able to appreciate. It places us deeply in his debt for so much concrete detail, left available for the use of others and not obliterated by synthesis. But with all the infinite capacity shown for amassing details, the author misses his point, mainly because he has not been able to give to the agricultural life, which should have been the heart of his book, the same care as to the question—admittedly easier—of the pastoral life. R. A.

ASIA

A HANDBOOK FOR TRAVELLERS IN INDIA, BURMA, AND Ceylon. Fourteenth Edition. *London: John Murray* 1933. 7×4½ *inches;* cxliv+812 *pages; plans and maps.* 24*s*

The issue of fresh editions of Murray's Handbook to India at intervals averaging about three years shows the estimation in which this publication is held. In the last edition (1929), under the editorship of Sir Evan Cotton, several rearrangements and additions were made. The present issue, under the same supervision, is practically identical in form and bulk, but is brought up to date. For example, the figures of the decennial census of 1931 have been incorporated as far as they were available at the time of going to press; some of the maps have been revised, and one of the N.W. Frontier Province inserted; the section on New Delhi has been re-cast in view of the completion of this Imperial capital; the important new harbours at Vizagapatam and Cochin find mention; a short section is devoted to the fifty-odd millions of the so-called "depressed classes," whose disabilities have recently been so conspicuous; and the further constitutional changes now under discussion are briefly explained. The question of the spelling of Oriental names and words presents difficulties. For place-names the spelling of the Imperial Gazetteer of India has been followed. In the case of vernacular words it would be as well to follow some recognized system, on the lines of that recommended by the Royal Asiatic Society, at least in the Glossary (pp. cxxxviii *sqq.*), which needs revision. Uniformity of spelling in the body of the Handbook could then be more easily preserved.

This is an excellent guide-book, and it should continue to be indispensable to tourists. C. E. A. W. O.

THE NAKED MOUNTAIN. By Elizabeth Knowlton. *New York—London: G. P. Putnam's Sons* 1933. 9½×6 *inches;* 336 *pages; illustrations and sketch-map.* 21*s*

The German-American expedition under Merkl reached a height of more than 23,000 feet in their attempt on Nanga Parbat in 1932, and their highest camp was pitched at that altitude. Climbing was the exclusive object, as the funds did not suffice for map-making or other scientific purposes. The attempt was made from the north and the route led over the ice-falls and snowfields of the Rakiot Glacier, where great difficulties were experienced owing to the rapid opening of the crevasses in the warm weather. Acclimatization proceeded satisfactorily, but unfortunately for various causes the plan of action was much delayed so that the principal assault could not be made till August. By that time bad weather had come on, so that the climbers never had a chance, for fresh snow lay all over the mountain in enormous quantities and men sank into it up to the waist.

As the season advanced and the formation of the glacier changed continually the party were forced into a dangerous position where they were exposed to the avalanches that fell 14,000 feet down the cliffs above them. No wonder that to the Hunza porters "this avalanche was the last straw indeed." It is not surprising that there were several strikes during which some of the men deserted.

Unfortunately for the coolies they were in a difficult position, because as Miss Knowlton ingenuously puts it in a quotation from the comments of the British officer who had procured the coolies: "The mayor recruited them at the suggestion of the political agent at Gilgit. The jemadar is a personal friend of the mayor's. He'll certainly try his best to make them stay with us. And they know that I'll report just what has happened, and they know, too, what the mayor can do to them if they leave us without good reason, like this. He has the power to take away any one's land, or even to banish him completely from Hunza." So most of the coolies returned. It certainly says a good deal for Nanga Parbat that in spite of all these wheels within wheels some of the more persistent Hunzas did contrive to escape from their task-masters.

The passage just quoted is, in the opinion of the reviewer, well worthy of attention, as it will be deplorable if in future this kind of pressure on coolies is to be the motive power to keep them reluctantly mobilized. The fact is that the morale of Himalayan porters depends on a good deal more than a conviction that the sahibs are bold and skilful. It is evident from this book that the increasing danger of the ascent towards the end of the season was not going to stop the Europeans if the coolies could be prevented from deserting. It may be granted that Hunzas are not the same sort of admirable mountaineers as the Mount Everest Sherpas. Yet it must not be supposed that even a picked body of Sherpas would be totally insensitive to the disturbing moral atmosphere of a ruthlessly die-hard forward policy. Indian villagers can see avalanches falling as easily as Europeans can, and the most preposterous rates of pay will only induce a half-hearted acceptance of such risks, while the market will be ruined to the discomfiture of future explorers.

It ought to be recognized that in recruiting porters for Himalayan mountaineering the only justifiable method is to choose, and if necessary import from wherever they may be found, the very best men that are available. High climbing ought to be accomplished, as on Mount Everest, with men understanding and trusting their leaders, and having something of a mountaineer's keenness, with some appreciation of the quality and degree of the risk that they may be reasonably expected to face. It is important, too, that if a British official joins an expedition from Europe to organize its transport, he should not merely attend to the efficiency of the porters, but should look after their safety. To do this successfully he must have an independent character and a thorough knowledge of ice and snow. His work will not be easy.

Two mistakes may be corrected: Nanga Parbat is not quite the seventh highest mountain in the world, nor was it two coolies who died with Mummery in 1895, but two Gurkhas who were attached to the expedition. The book is not only a brilliantly written record of a gallant adventure, but incidentally pays a most effective tribute to the outstanding life and character of the young American, Rand Herron, poet, musician, and mountaineer, who was assistant leader of the expedition and was killed in a fall from the second Pyramid of Gizeh on his way home. C. F. M.

AFRICA

DIE OBERFLÄCHENGESTALT DER GEBIRGSLANDSCHAFT UTschungwe im Östlichen Mittelafrika, und ihrer Nachbarlandschaften Uhehe, Süd-Ussagara, Ost-Fuagi, Utemekwira. By GEORG V. PRITTWITZ UND GAFFRON. *Berlin: Schultze and Velhagen* 1932. $10^{1}/_{2} \times 7^{1}/_{2}$ *inches;* x+158 *pages; with separate case of supplements. M.*42

Although Tanganyika Territory not only lends itself admirably to geomorphological studies but actually demands an early working out of its physiography

as the only sound basis for more complex geological and geographical investigations, geomorphological monographs, as distinct from the more general regional surveys like those by Bornhardt, Uhlig, Jaeger, Obst, and others, have been conspicuous by their absence. In fact, since the first publication of this kind, H. v. Staff's 'Beiträge zur Geomorphogenie und Tektonik Deutsch-Ost-Afrika's' of 1914, which deals primarily with the morphology of the southern coastal area and its immediate hinterland, we have had no further contribution to this important subject.

One must therefore rejoice that Oberst v. Prittwitz und Gaffron, whose well-known and untiring topographical efforts in many parts of the former German Protectorate still form some of the best and most reliable foundations for the existing official maps, has given us in the work under review a carefully prepared and splendidly produced digest of his wide knowledge, gathered during many years of military and administrative activities, of the surface forms of the Uhehe Highlands.

The map on the scale of 1 in 300,000 is an elaboration and improvement of the author's own earlier edition of his surveys in Utschungwe (or Udzungwa in our official spelling), published in two sheets in *Mitt. a.d.D.Sch.*, vol. xiii, 1900, which has been considerably widened in nearly every direction by using all available pre-war material as well as a few rectifying features from two sketch-maps by the Tanganyika Territory Survey Department. Mr. M. A. U. Heathcote's map of the Mnyera Ruaha (*Geogr. J.*, February 1932), on the other hand, and the present reviewer's extensive Railway Reconnaissance maps of 1927 have, unfortunately, not been utilized. The latter might have formed a useful widening along the north-western margin of Von Prittwitz's map, all the more so as both surveys show a remarkably close accord in their hypsometric and barometric heights; and the former could have filled to a certain extent the still "white" patch in the south-western corner of the new map.

By recomputing a very large number of his own and other observers' barometric altitudes, Von Prittwitz has attained a very high degree of accuracy, so that over large areas of the region his 100-metre form-lines may almost be looked upon as contours. The central portion of the Kilombero Scarp, together with its uninhabited and very hilly foreland, a most inaccessible bit of ground, still continues largely and admittedly as conjecture. The same applies to the south-eastern corner of the scarp-foot country. But, taken all round, and judging from the many parts intimately known to the reviewer from his own field work in 1925–1927, the correctness of this map, within the limitations of its scale, cannot be doubted, especially as all conjectured features are clearly marked as such. A "silent" copy, issued with the volume, facilitates its use for study, and twenty-six pages of the text are devoted to discussions of the methods used and of the improvements achieved.

One major inaccuracy, which might have been avoided, should however be put right: In the absence of a height at the lower end of the Great Ruaha's uppermost gorge (between Kikosse and the Mbungu confluence, along the northern edge of the map) the river has been given an even gradient by interpolating between the known 500-metre and 700-metre contours, although the existence of the gorge and of a very much steeper gradient through it was known to the author and is actually illustrated by a very beautiful and instructive set of photographs (Plates 35 to 40). This results in a total drop over the gorge stretch of only about 25 metres, whereas the Railway Reconnaissance of 1927 has determined this drop to be in the neighbourhood of 125 metres.

The bulk of the book (pp. 36 to 119) is given to a minute and most helpful description of the surface features from which all attempts at explanation are

strictly omitted. When reading through these pages, which appear to be based largely on detailed field notes by the author, one cannot but admire the care with which the facts have been observed and recorded. A more hurried generation which relies on mechanical transport to gad about misses much, if not most, of the detail.

As with the map, the present reviewer has not found many statements in the text which might justifiably be called erroneous. A large number of very beautiful and morphologically most instructive photographs, taken nearly thirty-five years ago, and excellently reproduced, are contained in a separate volume. A few pages are devoted to a consideration of the rocks which build up the country. This is based merely on the somewhat scant pre-war material, and leaves out of account the recently very much increased knowledge which the Officers of the Tanganyika Territory Geological Survey, and others, have gained in at least the northern and western half of Uhehe.

Finally, an admittedly tentative and inconclusive effort is made in two short chapters to explain the tectonic structure and the morphological history of the country. The remarkable structural pattern produced by two sets of intersecting dominant directions, and so beautifully brought out on the map is, of course, recognized and analysed in a number of profiles. But in the reviewer's opinion a certain amount of confusion is introduced by applying the terms "somalian" and "erythrean" direction, especially as the latter, which is definitely defined as striking south-east to north-west, is in fact found nowhere in the area. "Somalian" (south-west to north-east) and "meridional" would seem to be more appropriate terms. The notion that deep-seated jointing of a postulated granitic mass has been the primary cause for this structural pattern is evidently given preference by the author, who seems to have missed the possibility of explaining the observed facts by the concept of an antithetic structural adaptation, by differential vertical movement and tilting, to an uplift of wide regional dimensions. The history, admittedly purely hypothetical, of the Great Ruaha's puzzling zigzag course through the uplifted blocks of eastern Uhehe as sketched by Von Prittwitz, is not very convincing.

To the reviewer who has spent a good deal of time on collecting structural facts throughout East Africa it has become clear that a type of structure very similar to that revealed in this fascinating map and book is to be found along almost the whole vast circumference of the Unyamwezi–Victoria high basin, and that only by studying that great region as a whole can one hope eventually to approach a solution of the many problems involved. In the meantime one should not forget that the outstanding merit and the great value of Von Prittwitz' work consists in the abundance of well-observed and clearly documented topographical and morphological fact of the very kind which, better than anything else, will help towards the final goal.

A very interesting and helpful short paper on the altitude of the old Ulanga Station and of the gradient of the Ulanga (Kilombero) River forms an appendix to the book. C. G.

NORTH AMERICA

L'AMÉRIQUE DU NORD: Etats-Unis, Canada et Alaska. By RAOUL BLANCHARD. (Géographie pour tous). *Paris: Fayard & Cie* 1933. 9×5½ *inches;* 398 *pages; maps.* 25 *fr*

This is one of a series of Geographies intended for the general reader, and we wish that the author had taken advantage of this fact to omit much of the detail proper to a text-book of geography in favour of a more general treatment of the geographical factors involved in the development of the economy of the country

as a whole. The most interesting sections are those dealing respectively with the U.S.A. and Canada as political entities; and these might well have been expanded to include a discussion upon the geographical basis of Sectionalism in the two countries. Much the greater part of the book is occupied with a more or less orthodox account of the geography of North America on a regional basis. It is well and authoritatively done, and the book can be recommended as revision reading for the student of geography, though perhaps a little academic for the general reader.

LL. R. J.

UNHARBOURED HEATHS. By KATHARINE GÖTSCH-TREVELYAN. *London: Selwyn and Blount* (1934), $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 222 pages; illustrations.* 8*s* 6*d*

The meaning of this title is not explained. These are the recorded thoughts of a girl of twenty-two who suddenly decided to go to and across Canada alone and with only such impedimenta, including camping outfit, as she could carry on her person. In view of her distinguished forebears and relatives—she is a niece of Gertrude Bell—such a record may be expected to be what is known nowadays as "different." Certainly it is very far from being the diary of an ordinary globe-trotter. Hers was a bold and at times rather mad adventure, even though she carried influential letters of introduction on which she could fall back in emergencies. Most of the journey was accomplished by boat, train, or lifts in passing motor cars, but sometimes she would do a stretch on foot and frequently spent nights in the wild. We get far more vivid descriptions of people and places than any mere tourist could give us. Special mention must be made of her accounts of the Calgary stampede and of her ascent of Mount Edith Cavell. She often asked for trouble but was quite clever enough to take care of herself. She might have spared us some of the men who made amorous advances towards her.

J. H. R.

CENTRAL AND SOUTH AMERICA

SANTIAGO DE LOS CABALLEROS DE GUATEMALA. By DOROTHY H. POPENOE. *Cambridge [Mass.]: Harvard University Press (London: H. Milford)* 1933. $9\frac{1}{2} \times 6$ *inches;* xiv+74 *pages; illustrations and plan.* 6*s* 6*d*

This little book, compiled from historical sources by the late Dorothy Popenoe, forms a succinct guide to the more important buildings, chiefly ecclesiastical, remaining from the Spanish Colonial period, 1543–1775, when "Antigua Guatemala" was a rich and proud capital. Santiago de los Caballeros de Guatemala, delightfully placed in the green vale of Panchoy, and shadowed by volcanoes, has always charmed travellers. Mrs. Popenoe's house there, carefully restored and furnished in Spanish style, displayed one aspect of the enthusiasm which she brought also to the preparation of this slight but interesting volume. A useful plan of the main part of Antigua Guatemala, as well as a few reproductions of drawings, by the author, of favourite buildings, will aid visitors to the old city.

L. E. J.

THE LIVINGSTONE OF SOUTH AMERICA: The Life and Adventures of W. Barbrooke Grubb. By the Rev. R. J. HUNT. *London: Seeley Service & Co.* [1933]. $9 \times 5\frac{1}{2}$ *inches;* 348 *pages; illustrations and sketch-maps.* 7*s* 6*d*

A three-years' apprenticeship training Yahgan boys on that bleak windswept island of Keppel which juts northwards out of the western group of the Falkland Islands served to prepare Grubb for what eventually became his life's work. Scattered over hundreds of thousands of square miles of mountain, forest, and plateau in the interior of South America, between Orinoco and Bermejo, there roamed varied tribes of Indians whose grade of civilization was of the very lowest.

It was Grubb's task to improve the lot of those Indians who inhabited the Gran Chaco of Paraguay and Argentina.

His method was slow but sure. Contact first came in January 1890 with degenerated Indians living on the right bank of the River Paraguay; there followed many lonely journeys westwards from that river to visit the chiefs of the various tribes of Lenguas, Matacos, and Tobas. There were many dangers and much hardship, but Grubb never faltered in his policy of showing himself powerful above all Indian chiefs and skilful above all Indian witch-doctors. Confidence in him followed, thereby finally breaking down the power of the witch-doctors; infanticide, premature burial, and intertribal vendettas were suppressed. The establishment of mission stations amongst the tribes was the next step—farm centres with sawmills and other industries to distract the Indians from their age-long nomadic tendencies.

But Grubb was essentially a pioneer, an explorer into new and unknown lands; he therefore left to others the maintenance of mission stations after their establishment.

Evidence of the good results gained from Grubb's work gradually attracted the attention of national Governments, sugar planters, and cattle farmers; in 1910 he was pioneering west of the Bermejo to prepare Chaco Indians of Argentina for the annual work which Tucuman sugar planters were able to offer. But the crowning appreciation of his work came a few years before his death in 1930 from the Bolivian Government; and if we keep in mind the history of Indian labour employed in the silver mines of Potosi before 1800, if we have seen doors slammed and food denied to peaceful white men travelling through Indian villages of Bolivia, we can all the more appreciate Bolivia's request for Grubb and his mission stations.

The scene of Grubb's early struggles in the Chaco is well described; vast swamps and swollen rivers, mosquitoes, piums, snakes, and jaguars; dense forest and lianas; then scrub with poisonous thorn, or high grass-covered plains dotted with palms; to-day a battleground set for the armies of Bolivia and Paraguay, to-morrow a potential oilfield.

The book, written by one who has himself spent years in the Chaco country and who understands the Indians, their characters and language, is well worth reading; but the sketch-maps are somewhat poor. G. C. S.

GRUNDRISS DER KULTURGEOGRAPHIE VON ARGENTINIEN: Untersuchung eines südamerikanischen Lebensraumes nach anthropogeographischen und geopolitischen Gesichtspunkten. By FRANZ KÜHN. *Hamburg: Friederichsen, de Gruyter & Co.* 1933. 10×6½ *inches;* xiv+240 *pages; illustrations and maps.* M.16 (*Bound:* M.17.50)

To his outstanding work on the physical geography of Argentina ('Argentinien,' 2 vols., 1927) Professor Kühn has now added this complementary book on the human geography of the country in which he long served as a University teacher. Here he treats in section after section of almost every conceivable aspect of the human occupation; and, though a striking exception appears at first sight in the absence of any separate chapter on the economic life of the people, this subject, as Professor Kühn points out in his concluding note, forces itself constantly to the forefront, and is necessarily touched upon at numberless points in writing of settlement in a land the keynote of whose development has been material progress.

This book raises the as yet unsettled question as to what properly belongs to the province of human geography. With a zeal for thoroughness Professor Kühn discusses, for example, the validity of the evidence for the existence of pre-

historic man in Argentina, and with doubtful relevancy he introduces into his chapter on the political life such matters as the educational system, the Press, and the German element in Argentina. He devotes nearly a quarter of the book to the types of dwellings, an interesting subject which quite properly finds a place but seems to have received an undue share of space. In a comprehensive work on the human geography of any region we may reasonably look for such a choice of subject-matter and such an allotment of space to each topic as will serve to give a clear picture of the collective human organism in its environment. More especially is this desirable in the treatment of "new" regions where the relatively simple conditions make the end easier of attainment. Professor Kühn's book contains many excellent passages, but taken as a whole it lacks something in unity; it is rather a collection of papers, each individually of high value, than a closely integrated account in which everything is subordinated to a central purpose. In this way repetitions have crept in, a bad example occurring in two references to Ushuaia on p. 57 and p. 89, in which the same facts are given, while the name is spelt differently in each and the latitude is varied. Misprints of ordinary words, it may be added, appear occasionally.

If this book is in some respects behind its forerunner on the physical geography of Argentina, it does nevertheless represent a worthy contribution to the geographical literature of that country. It is suitably illustrated with simple yet original sketch-maps and photographs. It contains penetrating observations and criticisms, and it conveys to the reader some of the writer's appreciation of the grand scale of the scenery in Argentina and of the dramatic quality of the recent material development in the heart region of that land. E. W. S.

AUSTRALASIA AND PACIFIC

NEW ZEALAND HOLIDAY. By ROSEMARY REES. *London: Chapman & Hall* 1933. $7\frac{1}{2} \times 5$ *inches;* xii + 272 *pages; illustrations and sketch-map.* 8*s* 6*d*

After an absence of seven years Miss Rees returned to New Zealand, her home country, and in the next few months, by car and by train, covered most of the North Island and the South. 'New Zealand Holiday' is the result. Her book does not pretend to be one "of reference" on New Zealand, but a diary written in odd moments. As such it is entertaining, and easy to read. To those who have been in New Zealand her diary will revive many memories; to others it can give hardly the slightest impression of so beautiful a country.

Had she been able to do a little climbing perhaps Miss Rees would not have described the Franz Josef Glacier as "the sort of glacier you keep in the back garden and make a pet of." Nor, we think, is she correct in stating that Messrs. Peter and Alex. Graham, the famous mountaineers, have given their name to the pass known as Graham's Saddle at the head of the Franz Josef. The pass was first ascended in 1892 by Messrs. J. C. Fife, Malcolm Ross, F. G. Gibb, and *G. Graham* (see 'A Geographical Report on the Franz Josef Glacier,' by James Mackintosh Bell, New Zealand Geological Survey, 1910). A. C. B.

A TRAMP-ROYAL IN WILD AUSTRALIA: 1928–1929. By ARCHER RUSSELL. *London: Jonathan Cape* 1934. $8 \times 5\frac{1}{2}$ *inches;* 256 *pages; illustrations.* 10*s* 6*d*

This book gives an account of a journey on camel-back from Oodnadatta to the western part of the MacDonnell Range and back by way of Alice Springs. Owing to the extreme drought conditions that then prevailed the portion of the Australian "Inland" traversed was seen at its worst, and thus the blight of aridity is the dominant note of the whole book. Mr. Russell shows the born traveller's

keen interest in the landscape, the wild life, and the vegetation, and a true Australian pride in the sturdy characters of the Inland cattle-men. Yet except in the MacDonnell country he saw little on his way but monotonous desert or gibbèr steppe in which living creatures other than insects were scarce, though he had the advantage of being accompanied throughout by a white dingo-hunter of long experience, who provided him with many odd scraps of desert lore.

Accounts of the Australian interior based upon traveller's short experiences generally fail to give complete pictures: what is desert in a period of drought presents often quite another picture after rains, and the few isolated settlers are too preoccupied with the day's work and apparently too overpowered by their surroundings to impart much useful knowledge. Each traveller being thrown upon his own short-period observations, successive reports are likely to vary. Yet one thing is certain, that the stock-carrying capacity of much of the arid interior of Australia is determined by drought periods—and is almost nil.

Mr. Russell writes in an easy style with interludes of racy dialogue. He has however been sparing of illustrations, and he includes no map to show the stages of his journey. E. W. S.

RELIGIOUS AND COSMIC BELIEFS OF CENTRAL POLYNESIA. By Robert W. Williamson. *Cambridge: University Press* 1933. 9½×6 *inches;* Vol. I, xx+400 *pages;* Vol. II, 398 *pages; map. 25s each volume*

Students of ethnology were grateful to Mr. R. W. Williamson for his valuable work 'The Social and Political Systems of Central Polynesia' (three vols., Cambridge, 1924), and now their gratitude is mingled with regret that he should have died before he had quite finished his 'Religious and Cosmic Beliefs of Central Polynesia.' His secretary, Miss M. Campbell, has seen the book through the press and has compiled an admirable index. It seems a pity that Mr. Williamson confined his attention to Central Polynesia, as the religious conceptions of the Hawaiians and of the Maori are of great importance, and without a knowledge of them a complete understanding of Polynesian religion is impossible. Those who have delved into Polynesian mythology and religion are aware that many recorded statements are hazy or inconsistent, and he is a bold man who attempts to reduce them to some sort of order and consistency, but the exhaustive reading and legal training of Mr. Williams have enabled him to give a rational and consistent survey of these debatable matters. The subjects dealt with include myths of creation, beliefs about heavenly bodies, time reckoning, conceptions of the soul during life and after death, death customs, the origin of death, the gods Maui and Tiki, the discovery of fire, the relation of the earlier to the later gods, etc. Each section is usually prefaced with some preliminary remarks; then follows a description of the beliefs of the several island groups, and as these are always referred to in the same order it is easy to discover what are the distinguishing features of each of those groups; finally, in his "Observations," Mr. Williamson discusses the evidence with clarity and impartiality.

Mr. Williamson makes out a very good case for his fundamental hypothesis that, though there are no traditions as to their place of origin or their primitive condition, the earliest immigrants into Polynesia believed that the souls of the dead passed to an underground destination connected with volcanoes and subterranean disturbances, of which the well-known god Maui was probably the deity; there were other members of the Maui family, among whom the god Tiki was the most important. At later periods there came to the Pacific groups of immigrants who believed that the souls of the dead passed to a place on or above the Earth. Of these there appear to have been two main sections: the earlier immigrants were worshippers of the gods Tane, Atea, Rongo, etc., and the later

were the great voyagers whose movements to and in the Pacific are recorded in the Rarotongan and other "logs" and in various traditions. It was they who introduced into the Pacific the worship of the great god Tangaroa, and they are termed the "Tangaroans" by Mr. Williamson. He regards the advent of the "pre-Tangaroans" and Tangaroans as being very much more recent than that of the "Maui-volcano people," and as both sections were people of more advanced culture than the previous inhabitants, they probably imposed their beliefs on the latter, and as they certainly had very old traditions we may reasonably believe that it is to them, or some branch of them, that we must attribute the origin of beliefs in an ancestral home, and the return of the souls of the dead to that home.

Though Maui or some member of the Maui family was credited almost everywhere with remarkable doings and as exercising certain functions, there were numerous substituted gods to whom these activities were also attributed. Different gods were substituted in different islands and groups, some of whom were the leading deities of, or were of high importance in, those areas. Thus a good many of the conflicting beliefs and traditions doubtless had their origin in the competition between the cults of the different gods, whose worshippers have tried to establish, and perhaps to magnify, the greatness and importance of their own deities.

Mr. Williamson has provided a mass of well-documented material which will be of great assistance to students of comparative religion and of ethnology, and it is saddening to think that he did not live long enough to know how much his labours are appreciated. A. C. H.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

A SHORT COURSE IN ELEMENTARY METEOROLOGY. By W. H. Pick. Fourth Edition (Completely Revised). *London: H.M.S.O.* (*for Meteorological Office*) 1933. $9\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 140 *pages; diagrams and maps.* 2*s* 6*d*

The abrupt commencement of this book without a preface makes it difficult to follow the author's scheme in arranging his work under the three headings of General Meteorology, Synoptic Meteorology, and The Upper Air, or to understand why there is no specific treatment of climatology. The book should appeal particularly to college students, since it is thoroughly up to date, especially on the more technical side of the subject, and the physical explanation of weather processes is exceptionally clear and terse. The style however is somewhat marred by the author's anxious habit of constantly repeating the phrase "as has already been said."

The importance of diligent observation of the sky and clouds is impressed upon the reader, but it can hardly be said that the author has made the best use of his opportunity to record original observations of his own. The narrow luminous rings round the sun and moon, called halos, are mentioned in connection with the higher cloud-sheets as caused by the refraction of light through ice-crystals; but there is no reference whatever to the series of rings closer to the luminary with the colours in reverse order known as coronae due to diffraction of light by water particles in lower cloud-sheets. Nothing is said about that peculiarly interesting form of good visibility known as "nearness," often regarded as a harbinger of rain. It is probably a kind of mirage due to stratification of the atmosphere in certain types of unsettled weather.

The least satisfactory chapter is that on weather-lore. It is no doubt true, as Mr. Pick says, that the St. Swithin's legend is nonsense according to the letter; but it is not so easily disposed of if a little regard is paid to the spirit, and one may

perhaps see in this saying the countryman's recognition of a tendency for the weather in the later weeks of the English summer to be either very wet or very dry.

Again, the well-known prognostic about red sky in the morning is dismissed by Mr. Pick as preceding a fine as often as a wet day. But what matters is not the mere fact of redness but its kind and quality—the picture which the sky presents to the spectator, always difficult to render in words and impossible to codify in a telegraphic weather report. When at sunrise the sky is an angry red over a wide extent it usually implies that the first cloud-sheets of a depression advancing rapidly from the west (the usual direction) are being lit up and rain is probable; but the same effect at sunset signifies the retreat of the clouds eastwards and a fine night is likely. That this weather proverb is both ancient and widespread is shown by the interesting fact that it figures in the New Testament (Matt. xvi. 3). Finally, why should it be assumed that "February Fill-dyke" is wrong because February is one of the months with least rain on the average? It is a scientific fact, of which the countryman has personal experience, that the watercourses tend to fill towards the end of winter, so that floods are more easily started when the weather is wet than earlier in the winter. L. C. W. B.

THE ECOLOGY OF ANIMALS. By CHARLES ELTON. (Methuen's Monographs on Biological Subjects.) *London: Methuen & Co.* 1933. 7×4 *inches;* viii+98 *pages.* 3*s* 6*d*

The relation of the living animal to its environment, a branch of natural history now called animal ecology, has for ages been a source of interest. Darwin brought it very vividly before us. His mind was permeated with the idea of the web of life, essentially an ecological conception. Few paragraphs in the 'Origin of Species' stick more firmly in one's memory than that in which he connects the cats and the clover crop. The abundance of the clover crop depends on the number of humble bees; the number of humble bees on the number of field mice; the number of field-mice on the number of cats; the number of cats on the number of human inhabitants. Battle within battle, he tells us, goes on incessantly with varying success and unimaginable complexity.

But of late years this aspect of nature is receiving more exact study. Many naturalists, who a generation ago would probably have been collectors, are now devoting their energies to these living inter-relationships. The problems, as they are studied at present, are set forth concisely in this little book. How animal communities can be grouped; how each species fits into its special niche; how it is related to other animals, to the vegetation and physical environment; how and why it fluctuates in numbers; these and other branches of the subject are discussed in a clear untechnical manner. We have learnt much since Darwin's day, but still we are only on the fringe of a truly immense subject. R. W. G. H.

ECONOMIC AND HISTORICAL GEOGRAPHY

SINO-PORTUGUESE TRADE FROM 1514 TO 1644: A Synthesis of Portuguese and Chinese Sources. By T'IEN-TSÊ CHANG. *Leyden: E. J. Brill* 1934. 9½×6½ *inches;* viii+158 *pages.* *Fl.*4.50

Despite its ambitious subtitle this is a disappointing book and adds little to what we already know of the subject. The author informs us in his preface that he proceeded in February 1932 from Spain to Cambridge, Mass., where the greater part of his research work was done. He could have saved himself a lot of time and trouble had he remained in the Iberian peninsula and carried out his researches in the archives at Lisbon and Evora, where there is far more to be found than in the library at Harvard, though this University does indeed possess

a fine collection of Portuguese manuscripts, which the author does not in fact appear to have used.

Dr. Chang devotes the first thirty pages of his book to an historical sketch of China's maritime trade down to 1513, which although an able enough survey, has been much better done by Professor Pelliot in his lengthy article on "Les grands voyages maritimes Chinois au debut du XV^{e} siècle" (*T'oung Pao*, vol. xxx, 1933, pp. 237–452). Nor does Dr. Chang break much new ground in his section on the early Sino-Portuguese commercial relations, for it is little more than a re-hash of Ferguson's well-known essay, 'Letters from Portuguese Captives in Canton,' with some of his identifications of Chinese personal and place-names corrected and amended from the original Chinese sources. There are some notable omissions from the Bibliography printed at the end of the work, including Bocarro's 'Decada XIII,' which contains several chapters on Sino-Portuguese trade in the early years of the seventeenth century; Sir William Foster's 'English Factories in India' series which teems with allusions to Macao and its trade, and which, together with the Hakluyt Society's edition of Peter Mundy's 'Travels,' gives a far better account of Weddel's visit to Macao and the Pearl River in 1637 than the scrappy account of Danvers on which the author has relied. More serious still is the omission of any reference to the three volumes hitherto published of the 'Arquivos de Macau,' which contain a mass of information on Sino-Portuguese trade in the period under review, as do also the 'Livros dos Monçoès' manuscript volumes in the National Archives at Lisbon. Another invaluable source for the history of Sino-Portuguese trade during the first quarter of the seventeenth century which is unknown to Dr. Chang, are the papers of Dom Francisco Mascarenhas, who was Captain-General of Macao from 1623 to 1625, which are still preserved at Evora, and which contain, *inter alia*, a contract with three Chinese gun founders for casting cannon at Macao. Many other mistakes and omissions could be mentioned, but it will suffice to say that although the book professes to deal with Sino-Portuguese trade, no information whatever is given regarding details of prices, values, methods of lading ships, stowing goods, and the fluctuating values of coinage, currency, and weights at different periods, though such information is to be found in contemporary Portuguese sources by those who know where to look for it.

C. R. B.

THE PRIVATE LETTER BOOKS OF JOSEPH COLLET. Edited by H. H. DODWELL; with an Appendix by CLARA E. COLLET. *London: Longmans, Green and Co.* 1933. 9 × 5½ *inches;* xxiv + 256 *pages; portrait and sketch-map.* 10*s* 6*d*

Joseph Collet's ancestors had been connected with trade for centuries. Succeeding to his father's business as a merchant in the City, he was driven by misfortune into bankruptcy; but his personal character and credit being unimpeached, the East India Company offered him, in 1710, the post of Deputy Governor of their settlements in Sumatra with a prospect of subsequent preferment at Madras. The expectation of being able to save enough money to discharge the balance of his debts, which he, though legally absolved, felt bound in honour to pay, conduced to his accepting the offer. No connected history of the English settlements in Sumatra between 1685, when the first was established at Bencoolen, and 1825, when in pursuance of a treaty with the Dutch we finally vacated that island, seems to have been written: even Marsden gives us scanty information on this subject. Bencoolen, where Fort York had been erected to accommodate the Company's servants, had an evil reputation for unhealthiness, and few appointed to it and other factories on that coast had much hope of

surviving. It was here that Collet assumed office in 1712, after an adventurous voyage. The unsuitable situation of Fort York so impressed him that he had it abandoned, and Fort Marlborough (completed after he left) built on a better site on the south side of the bay. In four years, by dint of vigorous and conscientious administration, he so improved the Company's affairs in the island that he was promoted in 1716 to Council at Madras, then the largest settlement in the East, where in 1717 he became Governor, a post he held till his retirement in 1720. He had succeeded, by the help of lawful trade, not only in paying off his debt of honour, but also in saving a moderate fortune, while preserving his personal reputation.

The letters in this volume have been selected from those written to relatives and friends between 1711 and 1719. They contain little of special historical or public importance, treating largely of family affairs and questions of religious doctrine, on which subject Collet had very pronounced views; but they bear the impress of the forceful character and strong sense of moral and religious duty that regulated his conduct. The letters from Sumatra however throw light upon the difficulties with which the Company's officers had to contend in that island, the very high mortality caused by the climate and conditions of life, and the nature of the relations with local chieftains. Collet's tenure of office at Madras was marked by no outstanding events. The most interesting matter in the letters of those three years was set forth in a paper by Miss Collet read by Sir Charles Todhunter at the session of the Indian Historical Records Commission held at Madras in 1924.

C. E. A. W. O.

THE OBSERVATIONS OF SIR RICHARD HAWKINS. Edited from the Text of 1622 by JAMES A. WILLIAMSON. *London: The Argonaut Press* (Thirteenth Publication) 1933. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches;* xcii + 190 *pages; maps.* 36s

In his biography of Sir John Hawkins, now recognized as a standard work, Dr. Williamson presented, in place of the popular conception of the man as a rough-mannered sailor chiefly notorious for slave-trading, a carefully authenticated portrait of a first-rate naval strategist and an administrator to whose skill and tireless devotion the efficiency of the fleet which defeated the Armada was primarily due. By a somewhat different method, but with the same accurate scholarship, he now shows us the son, Sir Richard Hawkins.

Sir Richard's 'Observations' constitute the chief extant authority for naval organization and day-to-day life on board ship in the time of Elizabeth. The book is a mine of information on such points as the "Care of steeringe," "Corruption of victuall," and the avoidance of scurvy, "prevention of annoyances in Harbours," "a new device for stopping a Leake without board," the "best manner of sheathing," and so on. It is indeed an indispensable text-book for the student of naval history during the period. For this reason alone the present Editor has rendered a valuable service in furnishing a new edition with an accurate text; for that used in the 1847 and 1878 editions was far from being accurate. The present text is carefully printed from a photostat reproduction of the original text of 1622. As a narrative of a daring attempt to penetrate the Pacific it is a classic. In good Elizabethan prose the author relates the tragic story of the last voyage of the *Dainty* in 1593, a ship which, as he sadly remarks, "never brought but cost, trouble and care." The voyage down the coast of Brazil, the terrific struggle with wind and current through Magellan's Strait, the cruise up the west coast of South America, and the culminating disaster in the fight with Don Beltran de Castro against fantastic odds are told with vivid and moving directness. This last fight (the basis of Kingsley's description of the *Rose's* duel with the *Madre Dolorosa* in 'Westward Ho!') ranks with that of

the *Revenge*. Throughout Sir Richard is at pains to teach his successors to avoid his own misfortunes by an unsparing exposure of his own mistakes.

Dr. Williamson opens a lengthy introduction with a fascinating survey of the origin and development of the Elizabethan scheme for establishing a great British Empire in the South Sea, remote from Spanish or Portuguese claims and possessing independent access by the Straits of Anian. He traces the beginnings of the idea from the misinterpretation of Marco Polo's Lochac and Malaiur to the identification of the unknown land-mass with *Terra Australis*. In passing, it may be noted that he comes down strongly in favour of the view that the Dieppe maps represent actual exploration of the Australian coast-line. The contact of Englishmen such as Roger Bodenham and Henry Hawks with the early Spanish explorers of the Pacific is linked up with the geographical theories of Robert Thorne and John Dee, which led up to that tantalizing puzzle—the purpose (or purposes) of Drake's voyage of 1577, on which the discoveries of Professor E. G. R. Taylor have thrown much valuable light in recent years. Three possible motives are attributable to Drake and to Hawkins, who subsequently followed him through the Straits of Magellan: plunder on the Peruvian coast, the discovery of *Terra Australis* and a means of safe communication therewith by the Straits of Anian, and the establishing of a spice trade with the Moluccas. The first and the third aims were successfully pursued by Drake, who paid a merely perfunctory attention to the second. Dr. Williamson is of the opinion that Hawkins's main objective was possibly the Unknown Continent. But the evidence is not conclusive, and he does not press the point. It is difficult to understand why, if this was Hawkins's chief intention, he should have refrained from saying so. At the time of the publication of the 'Observations,' Sir William Courteen was moving for a patent to monopolize "all the lands in the south parts of the world called Terra Australis Incognita." If Hawkins regarded this attempt as an intrusion upon his preserve, the natural course would seem to be to state his own claim, or alternatively, if his attitude was benevolent, to give added point to the warning against diverting the enterprise to Peruvian plunder. There may however, as Dr. Williamson suggests, have been good reasons for concealment which are unknown to us.

Other points worthy of note comprise the new material relating to Sir Richard's career and the case made out (conclusively as it seems to the present reviewer) in favour of Hawkins's discovery of the Falkland Islands. The Appendixes include a translation of his Examination from the original in the Seville Archives and of his letter to his father, Sir John Hawkins, written while a prisoner in the hands of the Spaniards.

The Editor's profound knowledge of the subject has enabled him, not only to present a long-needed "historical revision" of Sir Richard Hawkins, but also to set his exploit of 1593 in proper perspective against the background of contemporary geographical theory and practical exploration. V. T. H.

GENERAL

LA RACE, LES RACES, MISE AU POINT D'ETHNOLOGIE SOMATique. By GEORGE MONTANDON. *Paris: Payot* 1933. $9 \times 5\frac{1}{2}$ *inches; 300 pages; illustrations and maps. 25 fr*

In this work Professor Montandon sets forth attractively, and with much clarity as a teacher, his view of the present position of theory and classification of the races of man. He is well known as an exponent of *l'Ologenese*, a concept due in the first instance to Rosa. This is the antithesis of the Haeckelian theory that a new race or species arose from a single pair, one or both of whom had varied in

a particular direction. In contrast to this the Rosa-Montandon view is of a widespread population varying through (very probably) acceleration or retardation of features of growth, and thus changing its average type with the lapse of time. Two groups geographically isolated will not be likely, under this scheme, to vary about the same average, *i.e.* geographical isolation may promote appearance of races, as Wallace, Guppy, Romanes, and others held long ago. The tendency in more or less isolated groups is thus towards various specializations and the full expression of the race type is thus a *terminus ad quem* rather than an *origo a qua*. This is a very welcome doctrine, not of course enunciated here for the first time by any means; and it is fortunate that v. Eickstedt in his new work seems to reach the same view. It is a view that links geography and the study of race much more closely than they have sometimes been brought together.

One wishes that the author had introduced a little more discussion of archaeological distributions. We now have, for example, a fairly reasonable knowledge of the extent of the region with Chelleo-Acheulean cultures, and, thanks to the Kanjera skull and perhaps the Kanam namdible, we also have a little direct evidence, to add to the weighty argument from the handiwork of the implements of the more advanced of those cultures, that the Chelleo-Acheulean series are related to *Homo sapiens* rather than to any lower humanoid forms. If that is established, most students, with the exception of Menghin, would incline to see the home of *H. sapiens*, of this early phase at least, in the Arabo-African grasslands, no doubt over a wide area as the Rosa-Montandon view would suggest, but an area that can be sketched in provisional fashion.

Montandon's sketch (p. 119) of successive dichotomies giving rise to nine main human groups is open to several criticisms other than those he mentions. There underlies it too much acceptance of *l'Ologenese* as the sole process, whereas many would set beside this certain important suggestions as to migrations. The author, for example, makes the *Laponoïde* morphologically nearer to the *Europoïde* than to the *Mongoloïde*. Such views must be very doubtful, and evidently Montandon sees the difficulties, for, in his actual treatment, he simplifies things by adopting only five main races, *pygmoïde, negroïde, vedd'australoïde, mongoloïde, europoïde*. As regards the first he is in opposition to Speiser and others, who think the pygmies represent decadent branches of the negro peoples. Again, it is under the Negroids that he places the Dravidian subgroup. It is surely preferable to take account of the wavy hair and the moderate breadth of nose, and to group the general population of S. India, as Haddon and Elliot-Smith both do, rather with that of the Mediterranean region, North Africa, and parts of Arabia and of Indonesia, than with the negroes. This view takes full account of the existence of negroid strains in India, as argued by Hutton in his invaluable report of the 1931 Census of India (Vol. I, Part 1, 1933).

The problems of distribution and classification of the races of man are however so baffling that it is well to thank the author for much suggestive and thoughtful comment rather than to overemphasize divergences of view. H. J. F.

THE OLD EAST INDIAMEN. By E. KEBLE CHATTERTON. [New and Revised Edition.] *London: Rich & Cowan* 1933. 9×5½ *inches;* viii+308 *pages; illustrations.* 15*s*

THE INDIAN OCEAN. By STANLEY ROGERS. *London: George G. Harrap & Co.* 1932. 9×5½ *inches;* 254 *pages; illustrations and sketch-maps.* 7*s* 6*d*

It is now nearly twenty years since the original edition of 'The Old East Indiamen' appeared. This was written to fill a noticeable gap in the literature of the sea, and has remained, the author explains, the standard work on the subject. It is now long out of print, and the present new edition has been produced to meet a

demand that already exists. This being so, one is disappointed to find it leaving so much to be desired.

Commander Keble Chatterton is certainly to be thanked for the painstaking way in which he has amassed a great quantity of interesting and valuable information, much of which is not otherwise easily accessible, including a considerable amount of manuscript material from the India Office records. It is the more a pity therefore that the same care and thoroughness which have marked his researches are not apparent in the writing of the book. The story of the East Indiamen is told with detail, it is true, in its important particulars, from the time of the first British voyagers to India until the last of the Hon. John Company's ships had been sold and the Company dissolved. Unfortunately the earlier historical chapters are extremely difficult to follow, even by a reader already keenly interested in the subject. The early history of the East India Company may be involved, but the author has not succeeded in making confusion less confounded. There is often needless repetition, in slightly altered language. One example among many may be found in the descriptions of Admiral Linois's squadron on pp. 186 and 188. Some of the more interesting parts of the book are composed largely of quotations, which are, of course, most valuable when well chosen, although too much quotation makes difficult reading. The value of the quotations however would be much greater if their sources were more often given. In Chapter III, for example, of sixteen pages, quotation marks are opened and closed more than forty times, without a single reference to the authority. This may serve for the general reader, although he will find the early chapters heavy reading and may be tempted to skip them. But this is, the author claims, the standard work on the subject, and the student will find too little to satisfy. He will want to go beyond the author's authority to the originals, but cannot for want of references.

The author is much happier when in later chapters he describes the ships themselves, their voyages, and the life on board. Yet here again the book is marred by careless writing. An example taken at random may be found on pp. 212 and 213, where three out of four consecutive sentences begin with that overworked word "but." Some of the best passages towards the end of the book are those taken, with due acknowledgment, from James. Some accounts from contemporary logs are also of great interest. More details of the construction, rigging, and accommodation would have been welcome; too little is done to give one a picture of the ships themselves at different stages in their development. It may be that further information could not be found; but the glimpses afforded by the author whet the appetite for more.

On laying the book down one is forced to the conclusion that a great opportunity has been lost. A successful first edition was already in existence of a book which had long remained a standard work on a really important subject. The material had almost all been collected. Little more than careful editing and rewriting was needed. Yet the new edition is disappointing from cover to cover. The only changes appear to be for the worse. All the illustrations are new, and with the possible exception of those of the East Indiaman *Essex*, the illustrations of the original edition are much to be preferred, and are better reproduced. Finally, the omission of an index must be regarded as a serious blemish in a work of reference, the value of which is thereby materially diminished. There is still room for a really adequate book on the Old East Indiamen.

One turns to Mr. Stanley Rogers's book expecting to be entertained with pleasant and readable history and description unencumbered with heavily documented detail. Nor is one disappointed. The author has already told in earlier books the stories of the Atlantic and of the Pacific, and the present

volume deals in the same easy style with the Indian Ocean. It is not intended to have the scope of a learned treatise, but within its limits the subject is competently and comprehensively surveyed. The author has been able to grasp and hand on the romance in his theme, and has collected into his book a little of most things—with one important exception. Islands, early voyagers, the East Indiamen, privateers and pirates, war days, storms, monsoons and typhoons, wrecks: all these and more supply Mr. Rogers with his interesting chapters. The important omission one finds it hard to forgive him. He seems almost to have forgotten that there were, and still are, most fascinating native craft in the Indian Ocean. Surely these craft deserve a chapter to themselves. Yet they are scarcely mentioned.

Unfortunately, the illustrations, of which there are many, both coloured plates and pen-and-ink drawings in plates and in the text, fall far below the standard of the rest of the work. Mr. Rogers has supplied some useful and attractive sketch-charts, and he draws palm trees and island scenes delightfully. But his drawings of ships are sadly inadequate, both technically and artistically. The China Clipper of his frontispiece, to begin with, has the heads of her courses much farther out along the yard-arms than the clews of her topsails, and the ship is altogether a poor and unconvincing specimen. The drawing of the *Cutty Sark*, facing p. 118, is almost an insult to that beautiful vessel. And the author would do well to study the construction and rigging of sailing ships before making such a drawing as, for example, that on p. 218, or many others which are not worth the cost of the blocks. A seaman, glancing at the illustrations, would cast the book aside immediately. This would be a pity, for it is worth reading. Mr. Rogers has moreover provided an excellent index, the importance of which is too often overlooked by writers on the sea. F. G. G. C.

DESCRIPTIVE GEOGRAPHY FOR SECONDARY SCHOOLS. By Macdonald Holmes and John Andrews. Part One. *Sydney: Angus and Robertson* 1933. $9 \times 5\frac{1}{2}$ *inches;* xiv + 436 *pages; diagrams and maps*

This is a text-book of uneven merit produced primarily for use in Australia. The section on Australia is the best and a distinct improvement on current Australian text-books. But there are some mis-statements in the section on Europe and the British Isles, and in a good many cases the description of a country is curiously incomplete (*e.g.* Belgium and Germany).

As so often happens in text-books, many of the maps are too small to be of any use; the temperature maps are poor, and one map in the section on Germany has its names spelt in French. The map of British coalfields does not show the concealed field under the Firth of Forth, and shows the Kent coalfield inaccurately. In the map on p. 233 the River Ems surprisingly flows into the Rhine just north of the Ruhr. It is stated on p. 232 that both the Meuse and the Moselle flow into the Rhine gorge. Vague statements become definitely misleading in such cases as on p. 186, where it is stated that Chile and South Africa have a Mediterranean type of climate; whereas in each of these countries it is restricted to a small and well-marked section. On p. 273 there occurs the carelessly worded statement: "These cool wind-streams . . . are forced to ascend and condense." A. B.

THE MONTHLY RECORD

ADRIATIC COAST OF YUGOSLAVIA

The Geographical Society of Beograd has recently published as vol. 2 of their *Memoires* a translation into French of the general section of Professor B. Z. Milojević's work on the Dinaric islands and the Adriatic littoral of Yugoslavia. After a sketch of the geology, and the morphological processes, commencing with the post-Cretaceous and post-Eocene foldings, which the region has undergone, the author gives a detailed description of the present forms of coastal relief. He contends that the characteristic canals which, cutting across the general Dinaric trend, separate the islands and peninsulas, and penetrate the land, are not fluviatile in origin, but synclinal depressions formed by tectonic movements since the folding. Examples of drowned valleys however are to be found, also stretches of coast which have been regularized through the filling up of these rias by dejection cones. The climate is shown to be influenced, within its general Mediterranean character, by this penetration of the sea, and by the mountains, rising to 1500 metres, parallel to the coast. The sea has also played an important rôle in the social and economic life of the inhabitants; their history until recently has been a conflict between maritime and continental peoples. The construction of transversal railways is now linking them more closely to the interior. The monograph contains much bibliographical information, and many excellent photographs.

RECENT GEOGRAPHICAL WORK IN AUSTRIA

Two volumes, Nos. 16 and 17, of the *Geographischer Jahresbericht aus Österreich* were published in 1933. The first volume deals (edited under the auspices of the Geographical Institute of Vienna University) with details in the physical geography of the Alps. Dr. Maull discusses the question of the oldest surface-level, and suggests a synthetic method of attacking the main geomorphological problems. Dr. Burger examines the various theories of the rôle of ice in the evolution of the physical relief, and seeks to reconcile the more extreme views from his own observations in the Eastern Alps. Two other papers deal with the physical conditions of the waters of mountain lakes. The development of communications in the Eastern Alps is traced from prehistoric times by Dr. Wopfner, who stresses the relation between the economic development of the "Almen" and the opening-up of routes over the high passes. These offered in summer certain advantages over the lower, better known passes, but, with the concentration of population at lower levels, and wider economic changes, they have declined. The towns of the Tirol, as Dr. Metz shows in the concluding paper in this volume, were founded in the Middle Ages, as a result of this concentration, and reached their prime while the trade with Italy flourished, and the local mines were being worked.

The second volume contains three studies of German enclaves, in Slovakia and in Yugoslavia. The total number of Germans in the Slovakian areas is estimated to have been 100,000 in 1921, chiefly in and around Bratislava and Kremnitz, a figure which has declined relatively very considerably since 1880, largely through a fall in the birth rate. The Germans appear to have maintained their position mainly owing to the relative inaccessibility and poor quality of their settlement areas. In the Olsnitz district of the upper Mur valley (Yugoslavia) there were 2300 Germans in 1921, out of a total population of 54,000—though in certain areas contiguous to the Austrian frontier, their percentage was as high as 96. Another article demonstrates the use in cultural history of a study of peasant house types, with examples from the German settlements in Slovakia.

THE SIBERIAN "COLD POLE"

It will be recalled that in 1926 Professor S. Obruchev established a meteorological station at Oimekon on the upper Indigirka (lat. 63° 16′, long. 143° 13′, alt. 658 metres), and referred to the possibility that even lower temperatures may occur there than at Verkoyansk, some 400 miles to the north-west beyond the Arctic Circle (*Geogr. J.*, 1927, vol. 70, p. 468). The latter has hitherto been regarded as in winter the coldest permanently inhabited spot in the Northern Hemisphere.

In the *Meteorological Magazine* for January 1934 Mr. S. T. A. Mirrlees states that the mean temperature at Oimekon in January 1930 was 8½ degrees lower than at Verkoyansk, and considers it probable that the long-period normal at Oimekon is below −60° F. as compared with −58° at Verkoyansk, −46° at Jakutsk, and −21° at Semenovski mine situated some 900 metres higher up on the mountain range intervening between Jakutsk and Verkoyansk. He produces a map of this very cold area in north-east Siberia, giving a rough outline of the distribution of actual mean January temperature, and points out that it is not possible to apply the ordinary correction to sea-level because in this region a "temperature inversion" is the normal winter condition—the temperature being lower in the deep valleys than on the mountain flanks. It thus appears that while the entire region is extremely cold through the combined effects of continentality and high latitude, it contains at least two, and probably several, low-lying pockets where the cold is locally accentuated by topography.

Although the cold Siberian area is in summer warmer than any other part of the Arctic regions it is quite likely in winter to be colder in spite of its relatively southerly position on the fringe of the polar zone. But there is not sufficient evidence for the common assumption in modern text-books that this is an established fact. It must not be forgotten that on the Greenland ice-dome, which is intensely cold at all seasons by reason of very high altitude, Wegener in a single winter, which may have been a relatively mild one, recorded an absolute minimum temperature of −84° F., only 10° short of the long-period world record at Verkoyansk. In the vicinity of the North Pole the extent to which open leads may occur would mitigate the cold, but it is certain that extremely low temperatures must at times be caused by radiation from a snow cover over thick sea-ice in a region where night is unbroken for five or six months.

Thus Peary, on his 400-mile journey Polewards over the sea-ice from Cape Columbia in Grant Land, recorded a temperature of −59° F. in March in latitude 85° and −40° in the vicinity of the Pole in April with the sun already continuously above the horizon. From a close study of the *Fram* records Professor H. Mohn concluded that the average January and February temperature at the Pole was not higher than −42° F. Hence it is regrettable that of recent years certain writers in their anxiety to correct the cruder ideas of last century about the Arctic regions should seem to have lost a sense of proportion, almost conveying the impression that the climate of the North Pole is really not cold at all.

THE ZANZIBAR CLOVE TRADE

The Zanzibar Government in 1932 sent a mission of inquiry to the centres of the clove trade in the East to examine their organization, sources of supplies, and consumption with reference to the demand for the Zanzibar product. The Report by Messrs. G. D. Kirsopp and C. A. Bartlett has recently been published through the Crown Agents for the Colonies. The two important markets are India, with Bombay as the centre, and the Dutch East Indies. In the period 1922–1932, 31 per cent. of the output of Zanzibar was consumed in India, and almost the same proportion between the years 1927 and 1930 went to the Dutch colonies.

There appears to be some prospect of competition from Madagascar in the Indian market: in 1930–31, 4 per cent. of Indian consumption originated in that island. Penang is a market of some importance, drawing its supplies about equally from Zanzibar and Sumatra, though the former appears to be losing ground. Java however is the chief market of the Archipelago. Some years ago native cigarettes with an admixture of cloves were introduced. The demand has increased greatly, and to meet it there is now direct steamer communication between Zanzibar and Java. The prospects of the trade appear uncertain. There is some local clove growing, but the cloves now produced are not favoured for cigarettes. Successful experiments in growing cloves have been made in Penang and Serdang, though progress depends largely upon the future of rubber and other local commodities. There are also doubts as to the continuance of the Java cigarette habit, and the future of competition from Madagascar cannot be foreseen. To retain the trade therefore improvements in the Zanzibar clove are essential, and there is said to be room for better methods in the export trade, *e.g.* grading and prevention of adulteration, especially prevalent in the Bombay market.

THE ORINOCO BASIN

In 1901 and 1902, Dr. S. Passarge made a careful field study of the southern portion of the Orinoco valley between the right bank tributaries Caura and Cuchivero. At the time he was able to publish brief accounts of his work only: last year however the complete scientific results were brought out by the University of Hamburg in their *Abhandlungen aus dem Gebiet der Auslandskunde*. Dr. Passarge justifies this belated publication on the sufficient grounds that it is a record of observed facts, that the area has apparently not been studied by later scientists, and that, as the district is a typical portion of the Guayana, it has a more extended value.

The first part contains the detailed observations illustrated by drawings and diagrams made upon the various journeys, followed by a survey of the region as a whole, with a discussion of its particular problems. The southern limit is formed by the edge of the Guayana crystalline tableland, to which the land rises gently from the northern llanos of sedimentary origin. The effect of the annual flooding, the chemical and physical processes of weathering, and the formation of the "Inselberge" are among the subjects examined. A map on the scale of 1 : 300,000 accompanies the monograph.

THE GREENLAND FLORA

In *Meddelelser om Grønland* (Bd. 104, nr. 3) Tyge W. Böcher, who took part in the Scoresby Sound Committee's 2nd East Greenland Expedition in 1932, gives an account of his "Phytogeographical Studies of the Greenland Flora based upon Investigations of the Coast between Scoresby Sound and Angmagssalik." His work is largely an extension of that of Ostenfeld, but he pays special attention to an interesting phenomenon on the Blosseville Coast between latitude 68° 43′ and 68° 48′ to the north of Kangerdlugsuak. Here there occurs what is called a "floristic boundary" characterized by a concentration of southern and northern species, the former declining northward and trending inland where it is warmer than on the coast, the latter declining southward and likewise trending inland to find drier conditions. In the vicinity of Kangerdlugsuak and in Scoresby Sound there is also a decline in the number of species from the coast inland. A similar boundary is stated to exist on the west coast of Greenland but at a higher latitude in 71°.

On the Blosseville Coast the botanical change is related to a marked climatic

change between Scoresby Sound and Angmagssalik. The latter place lies on a part of the coast influenced by relatively warm water from the Irminger branch of the Gulf Drift, and has a mean July temperature about 4° F. higher than the former as well as an annual precipitation about three times as heavy.

The writer goes on to show in general that the flora of Greenland, which consists of different elements, is conditioned by considerable differences of climate prevailing round the coast. He recognizes four climatic provinces to which the flora of the country is related: the inland ice; the coastal area, very dry and cold north of the July isotherm of 40° F.; the coastal area, moist and less cold south of the said isotherm; and finally a subarctic province in the interior of the southern coast land where the mean July temperature reaches 50° F. In the last-named zone it is possible to distinguish between an inner and outer land corresponding with the fact that the July isotherms do not pass right across Greenland but bend upwards in the warmer inland.

CANADIAN EASTERN ARCTIC PATROL: FATE OF DR. H. K. E. KRUEGER

Through the co-operation of the different Government departments whose activities touch northern affairs an annual patrol now visits the coastal posts and missions of the eastern Canadian Arctic. The 1933 Patrol, commanded by Major D. L. McKeand, sailed from Montreal on July 8 and returned to St. John's, Newfoundland, on September 27. The vessel called at numerous posts on Hudson Strait, Hudson Bay, Baffin, Devon, and Ellesmere Islands, and at Robertson Bay, Greenland. The last-named place was visited in order to repatriate the Eskimos who had been employed in the search for the German scientist and explorer, Dr. H. K. E. Krueger and his Danish assistant, Mr. A. R. Bjare, who, together with an Eskimo and his dog-team, disappeared to the west of Ellesmere Island early in 1930. The search, which covered 3000 miles, was undertaken by the police post at Bache Peninsula, Ellesmere Island. A message was found in a cairn on the north-west coast of Axel Heiberg Island, stating that Dr. Krueger had visited Lands Lokk and was proceeding to Meighen Island. Bad ice and the scarcity of game prevented the police party from reaching Meighen Island, and the search was abandoned.

Apart from the accounts of routine work and special investigation, the report of the 1933 Patrol contains information of general importance. The post on Bache Peninsula, Ellesmere Island, hitherto Canada's most northerly post in the Arctic, has been withdrawn southward, to Craig Harbour, on account of the difficulty of reaching Bache Peninsula and the failure of the 1932 Patrol to get there at all. Pangnirtung, on Cumberland Gulf, Baffin Island, is described as "the busiest and most populous place in Canada's Eastern Arctic." It is the centre of the white whale industry, and has an Anglican hospital with very complete electrical and X-ray equipment. The report also shows that rail-communication has now reached Hudson Bay waters at a second point. Moosonee, on James Bay, is the new terminus.

ADMIRAL MOORE'S SEARCH FOR BOUVET ISLAND

On the return of Sir James Clark Ross from the Antarctic regions in the *Erebus* and *Terror* the Royal Society induced the Admiralty to send out a supplementary expedition to make magnetic observations close to the Antarctic ice south of the Indian Ocean. The barque *Pagoda* was hired for this service and the command was given to Lieutenant T. W. L. Moore, R.N., who had been an officer of the *Terror*.

In the course of the voyage southward from the Cape of Good Hope Moore

resumed the search for Bouvet Island which had been pursued without success by the *Erebus* and *Terror*. He did not go so far west as 6° E. before turning southward, and this has given rise to strictures on his efficiency as a navigator and even, on the natural-enough assumption that the search for Bouvet Island was part of the plan of his cruise, to reflections on his character as an officer who disregarded his instructions.

Efforts to find the original orders had been made without avail, and it is only recently that Lieut.-Commander R. T. Gould has succeeded in finding them in the Record Office. The instructions dated 19 October 1844 contain no reference to Bouvet Island but merely informed Lieutenant Moore, after embarking the magnetic observer and his instruments at the Cape of Good Hope, "to proceed on your voyage, leaving that place, if possible, about the middle of December, and having reached the meridian of Greenwich you are to proceed to the eastward between the parallels of the Cape of Good Hope and 60° or 65° South as far east as the meridian of 130° East."

It was January before Moore reached the Cape, his time was very short when he was able to sail on January 9, and in reaching the charted position of Bouvet Island before making for his appointed turning-place he was going as far as prudence allowed in the interpretation of his orders. He satisfied himself that the island was not where the charts placed it, and, unconscious of the fact that he had come within 20 miles of its real position, he resumed his direct course and carried out the purpose of his mission with all the fidelity and zeal expected of a naval officer.

Though nearly ninety years have passed since Moore received his orders we feel that the character of a gallant officer whose ability and honour had been questioned, however innocently, should be cleared, so that future historians will accord to his memory the honour that is his due. H. R. M.

EARLY FENLAND MAPS

The formation of a Fenland Research Committee, with a view to co-operative exploration of the Fenland from all points of view, was mentioned in the *Journal* in connection with Major Gordon Fowler's paper in the January number. One outcome of the movement has been an exhibition of Early Maps and modern Air Photographs, held at Heffer's Art Gallery at Cambridge, and a printed catalogue of the exhibits has been kindly sent us by the Secretary of the Committee, Dr. J. G. D. Clark, F.S.A. Of general maps of the whole area, many of them produced in connection with schemes for draining or otherwise improving the Fenland, the first in date is that showing the results of William Hayward's survey of 1604, as represented by an early eighteenth-century copy (the original is in the Fen Office at Ely). The first printed map is that of Hondius, first included in his Atlas of 1633 and several times reissued, or closely copied, in Holland. The amount of detail shows that it must have been based on unpublished material sent from this country. The important survey of Sir Jonas Moore, begun in 1649, which marked a great step in advance, was embodied in his large- and small-scale maps of 1684, both shown, and Dr. Darby remarks in his brief but excellent introduction that Moore's earlier maps have not survived. It may be of interest to note however that a map by Moore on the smaller scale, acquired a few years ago by the British Museum, differs from that of 1684, and judging from the paper on which it is printed would seem to have been issued not long after 1650. On the other hand Lea's Map of Cambridgeshire and the Fens, put down as probably of 1651–62, can hardly have been so early, as Lea is not known to have been in business till 1683. Later surveys of the fens include those of William Badeslade and others. There is a good selection of

maps of the counties in which the Fens are placed—by Saxton, Speed, Blaeu, Moll, Morden, Bowen, Kitchin, Jefferys, Roque, Cary, and others, but it was apparently not possible to secure original issues of Saxton's. This section reaches its climax in the fine map by Donald and Milne, 1794. In a third category come maps resulting from special surveys of parts of the area, which, as Dr. Darby remarks, provide intimate glimpses of the former condition of individual stretches of fen. One of Wisbech Hundred was made before 1597, and that of Walsoken, Walton, and Walpole, in 1636. Many other maps of this type must be in existence, and any information about them would be welcomed by the Committee, as only by assembling such local data can any ultimate synthesis of former Fenland conditions be drawn up. It should be said that the catalogue is arranged chronologically, and the only matter for regret is the absence of any indication of the scale or size of the maps.

The value of air photographs for the restoration of old surface features has been so often insisted on in the *Journal* that it is unnecessary to say much about this section of the Exhibition, which is introduced by a general sketch of the results so far obtained, with notes on the proposed plans for further operations. In conclusion attention may be called to an interesting collection of old maps of Lincolnshire (with parts of other counties), many of which are useful as illustrating the old state of the Fenland, to be found in the Society's Map Room. They include some not shown at Cambridge, one of these being the large map of Sutton and Mepall Levels, from the survey by William Ebstobb in 1750.

ATLAS OF ENVIRONMENT AND RACE

We have received from Dr. Griffith Taylor a recent publication of his—'An Atlas of Environment and Race.' This was prepared in connection with a series of lectures broadcast from Chicago last year, and contains over one hundred sketch-maps and diagrams in black and white. They form really a supplement to his earlier work, 'Environment and Race,' which was reviewed in the *Journal* for December 1927. The reviewer there paid tribute to the value of the "very clever diagrams," in stimulating other students. The aim is to illustrate his theories of the "zone and strata" distribution of mankind, and the part played by changing environment in its evolution. A dispersal centre in the Turkistan area is assumed, and held to account for the similarity in culture between Egypt and south-west Asia, rather than a cultural spread from the former. Many of these sketches bring out similarities in a striking way, though some of the analogies are not entirely convincing. The study covers so wide a field and so many sciences that it may no doubt be open to criticism in detail; nevertheless it is primarily to be commended as an attempt to develop the method of imparting knowledge graphically.

OBITUARY

FRANCIS HENRY HILL GUILLEMARD

In Dr. F. H. Guillemard, who died at Trumpington, Cambridge, on 27 December 1933, aged eighty-one, the Society has lost an old and valued member, one of the comparatively few survivors on its roll from the stirring days (geographically) of sixty years ago; for he became a Fellow in 1876, soon after graduating at Caius, Cambridge. With advancing years his connection with the Society had become less close than it had been, but in middle age he took an active part in its affairs, being a constant attendant at its Council meetings

during the years in which he held office, and contributing reviews and notices more or less regularly to the *Journal*. It was mainly due to his persistent advocacy that the special section devoted to Reviews was started in 1902.

Guillemard came of a fine old Huguenot stock, originally settled in Poitou, a member of which had taken refuge in this country during the Huguenot persecutions of the seventeenth century. He was the fifth son of Dr. I. G. Guillemard, of Eltham, Kent, where he was born on 12 September 1852. His bent towards travel was early gratified, for he visited Lapland while still an undergraduate. At Caius he had chosen the medical course, but though he passed through it with credit and ultimately took the M.D. degree, he never practised, being one of the fortunate few who could indulge their natural bent untrammelled by the need to earn a living. In 1877 he travelled in South Africa, and in 1881 served as doctor in the first Boer War. His opportunity came in 1882, when he sailed as naturalist with Mr. Kettlewell in the *Marchesa*, famous for its three years' scientific cruise in Far Eastern waters during which exploration and zoological work were carried out in Kamchatka, New Guinea, Borneo, and elsewhere. The outcome was a fine work in two volumes, written mainly in his rooms at Cambridge and published in 1886 under the title 'The cruise of the *Marchesa*.' It was at once hailed as worthy to rank with the classics of naturalist travel—standard works like those of Bates or Wallace. Soon afterwards Guillemard was instrumental in starting the Cyprus Exploration Fund, and himself spent some time in the island for ornithological and archaeological work. He gave some help to Mr. W. H. Mallock during the latter's winter visit to Cyprus described in his book 'In an Enchanted Island,' but for some unexplained reason his name is there disguised under the fanciful substitute "Mr. Adam."

In 1888 he was elected the first Reader in Geography at Cambridge, and set to work to qualify himself to deal with the general principles of the subject. But the task of lecturing seems to have been not really congenial, and he resigned after holding the post for a year. His advice and encouragement was however freely given to the few who in those days took a serious interest in geography as an academic study. His last experience of travel off the beaten track was when he accompanied Sir Charles Euan Smith on his mission to Morocco in 1892.

Though a charming companion to those admitted to intimacy, Guillemard was of a somewhat retiring nature, and his further work for geography was done in an unostentatious way, which has perhaps caused his services to the subject to be insufficiently recognized. He wrote an admirable Life of Magellan for the 'Great Explorer' series, and was General Editor of the 'Cambridge Geographical Series,' and the useful set of County Geographies published by the Cambridge Press, to which he acted as adviser in such matters. He largely rewrote the volume on the Malay Archipelago for 'Stanford's Compendium,' and put into shape for publication various works by other travellers, including those of Miss Kingsley on West Africa, as well as, in another category, Sir Clements Markham's 'Lands of Silence.'

In 1898 he took up his abode at the Old Mill House, Trumpington (formerly occupied by Dr. Peile, of Christ's), with its pleasant garden, in which he took much pride. His well-chosen collections of art and archaeology made the house a veritable museum, which he delighted to show to his visitors. They included the old wardrobe in which his ancestor had smuggled his son over from France, which had an honoured position in the guest chamber, together with choice examples of later English furniture. But chief among his treasures were the early water-colour paintings by distinguished artists, which under his will go to enrich the Fitzwilliam Museum. Many years ago he had given to our Society his extensive collection of prints and photographs of the waterfalls of

the World, and in 1888 presented a fine portrait in oils of Sir James Clark Ross taken on his return as a young man from Boothia Felix in 1833. It had formerly been owned by Admiral King of Madingley Hall, but had found its way into a dealer's shop, whence it was rescued by Guillemard, who had recognized it in passing. In his will he left to the Society his portrait plaque and a water-colour drawing made in Kamchatka. E. H.

JOSEPH THOMAS LAST

Mr. J. T. Last, who died at Shortlands on December 13 last, in his eighty-sixth year, had been a Fellow of our Society since 1895. He first went to East Africa in 1873, where he won a reputation for his ability, energy, and unrivalled knowledge of the Swahili language, and at the abolition of the legal status of slavery in 1897 was appointed Commissioner of Slavery for the Island of Zanzibar in the Administration of Sir Lloyd Mathews. He was a keen traveller and naturalist, and during this period made expeditions to Madagascar and, in 1885, to Portuguese East Africa—the latter being a journey undertaken on behalf of the Society principally in order to explore the neighbourhood of the Namuli Mountains, of which he gave an account in a paper read before the Society in 1887 and published in the *Proceedings of the R.G.S.*, New Series, vol. 9, pp. 467–478. It was interesting to find constant references to Mr. Last's Namuli experiences in the paper on the same subject published in the *Journal* a year ago by Mr. Vincent. In Zanzibar Mr. Last discovered the limestone caves at Makunduchi, in which there are large stalactites and stalagmites. Many specimens of new plants, particularly orchids, were sent by him to Kew.

Mr. Last was a man of robust and virile personality who carried through everything he undertook; he leaves a widow and six children, of whom one, Mr. J. S. Last, is now a District Sub-Commissioner in the Zanzibar Government.

R. N. L.

MEETINGS: SESSION 1933–1934

Ninth Evening Meeting, 5 March 1934. The President in the Chair

Elections: The Rt. Hon. the Earl of Aylesford; John Baines-Lewis; W. E. Brown; Mrs. Hilda Denman; Ekpo Ekpenyon Efiok; Rev. William Launcelot Scott Fleming; Mrs. Jessie Knight-Rawlings; Ernest Wilson Larby; Donald Eric Lyddon; Edgar Harry Roe; Edward Kenneth Sargison; Capt. G. S. C. Swinton; Frank Deaville Walker

Paper: The Second Antarctic Commission of R.R.S. *Discovery II.* By Mr. D. Dilwyn John

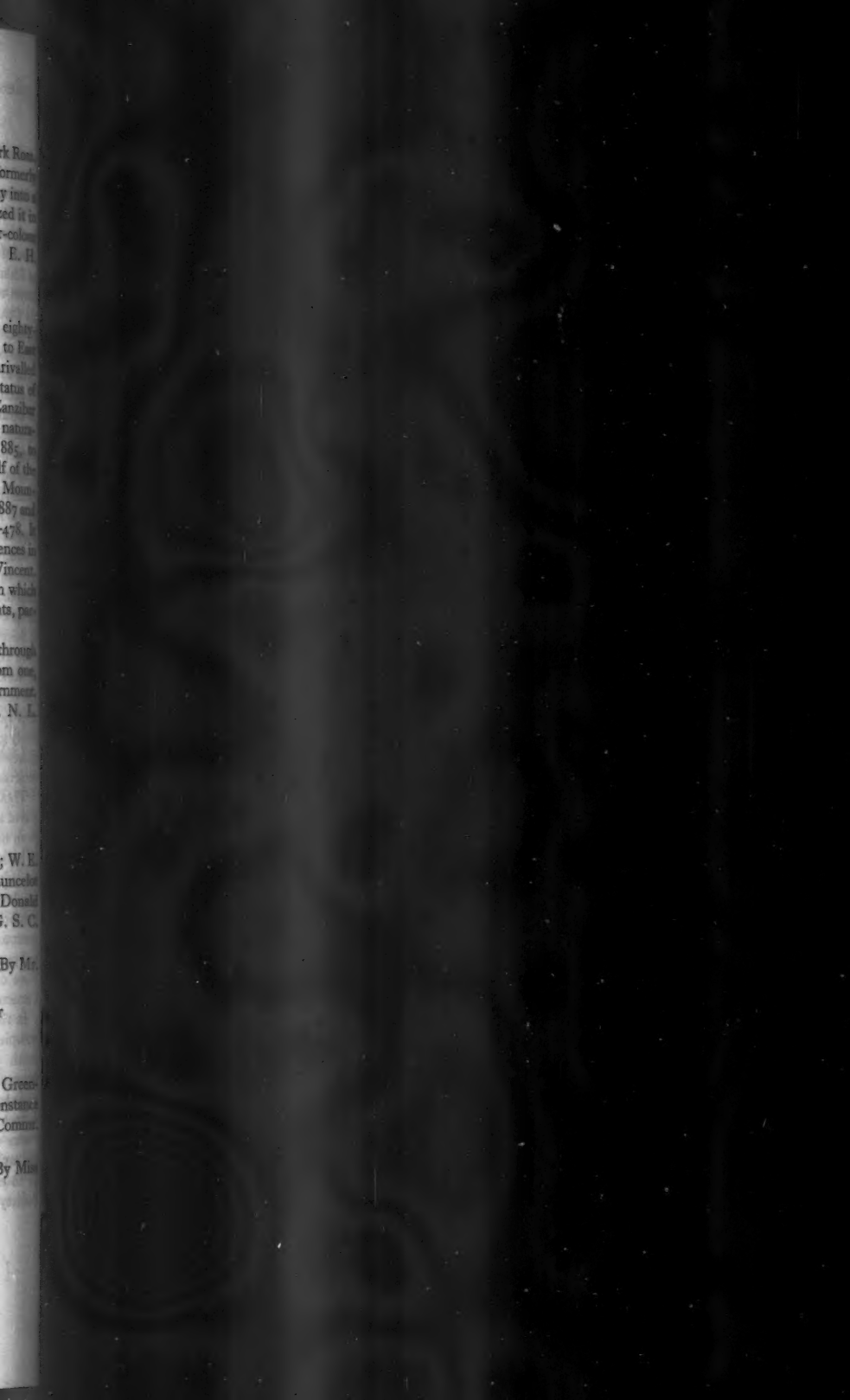
Fifth Afternoon Meeting, 12 March 1934. The President in the Chair

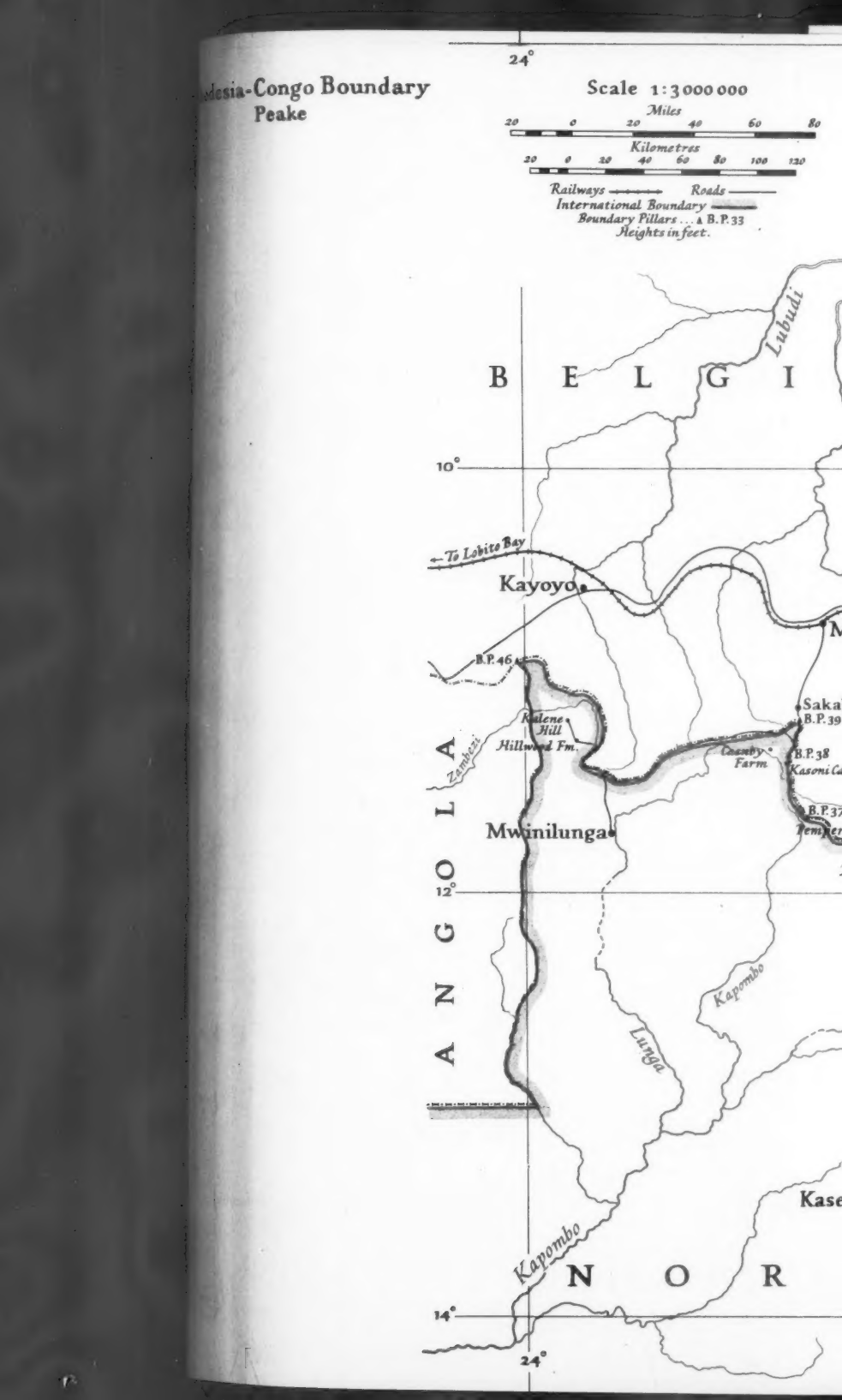
Paper: Scolt Head Island. By Mr. J. A Steers

Tenth Evening Meeting, 19 March 1934. The President in the Chair

Elections: Miss Ruby V. Berry; R. E. Cooper; Capt. Walter Edward Greenland; Miss Audrey Mary Harris; David Foster Munsey; Miss Constance R. Rogers; G. W. M. Russell; Neville Vincent Scarfe, M.A.; Lieut.-Comm. Cyril Theobald Roundell Searle, R.E.

Paper: The Bazars of Tangut and Trade Routes of Dzungaria. By Miss Mildred Cable

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B.P. 38
Kasoni Camp
B.P. 37
Elisabethville
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Lubumbashi
B.P. 36
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Nianksa Camp
B.P. 34
B.P. 33
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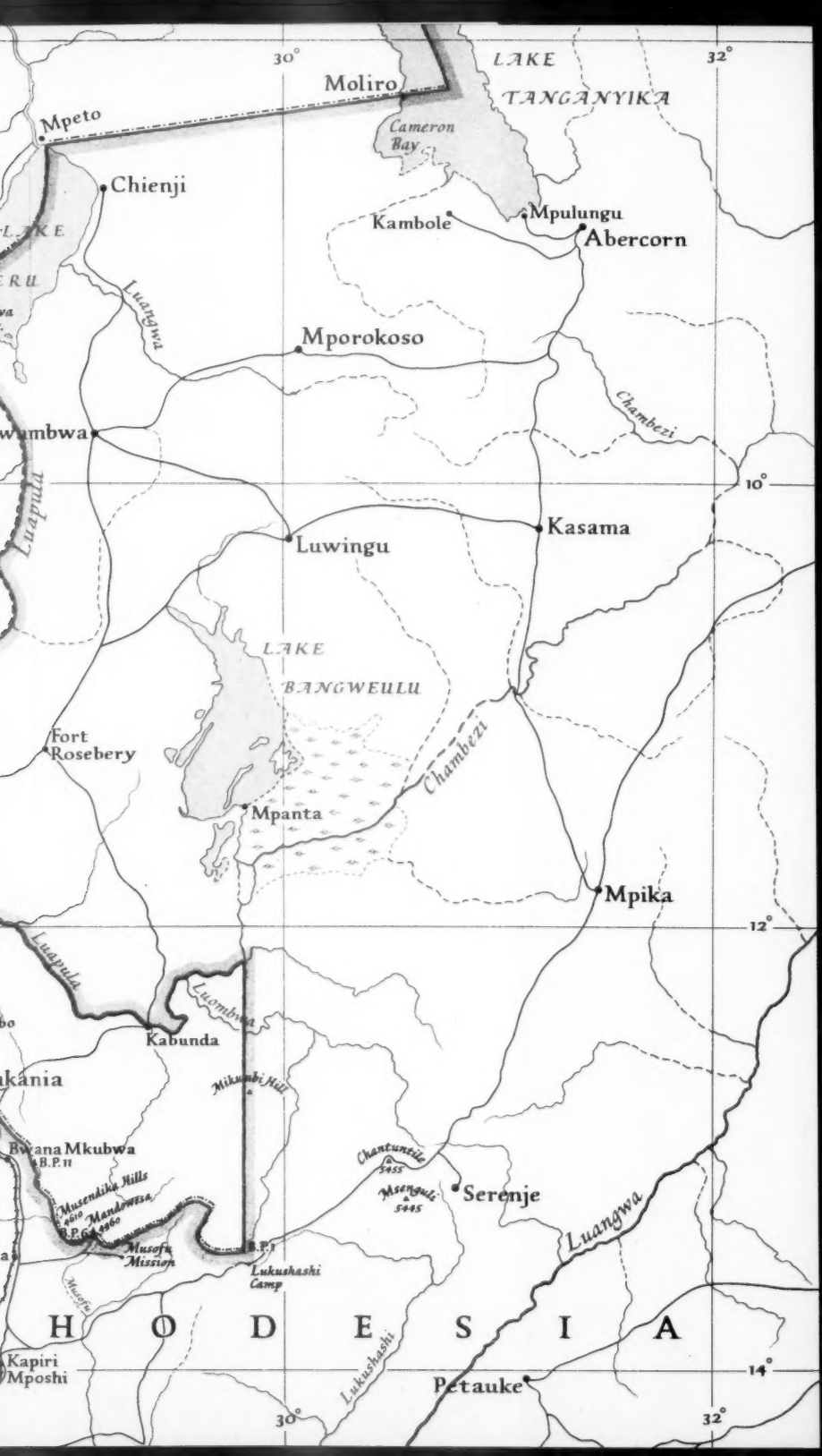
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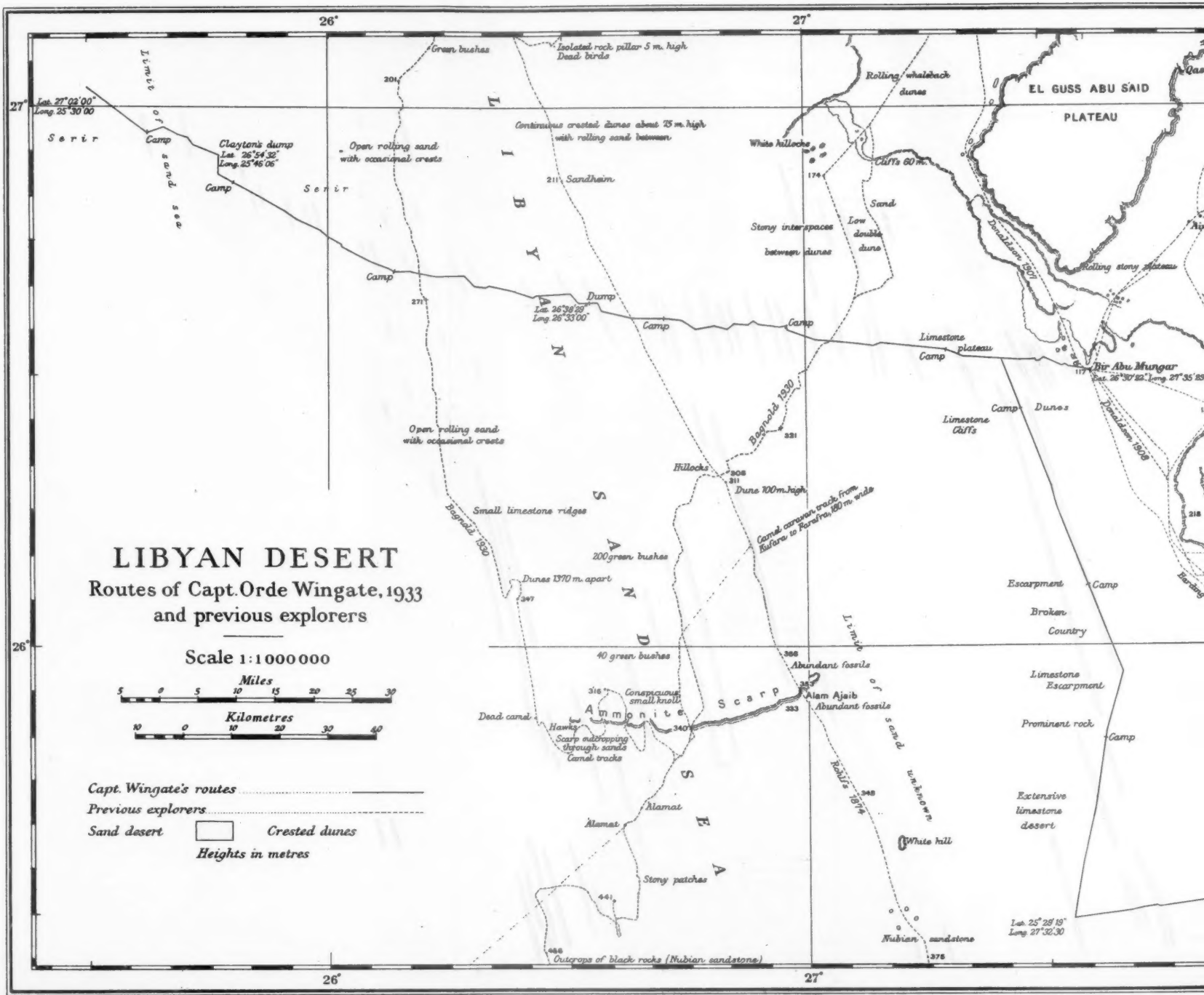

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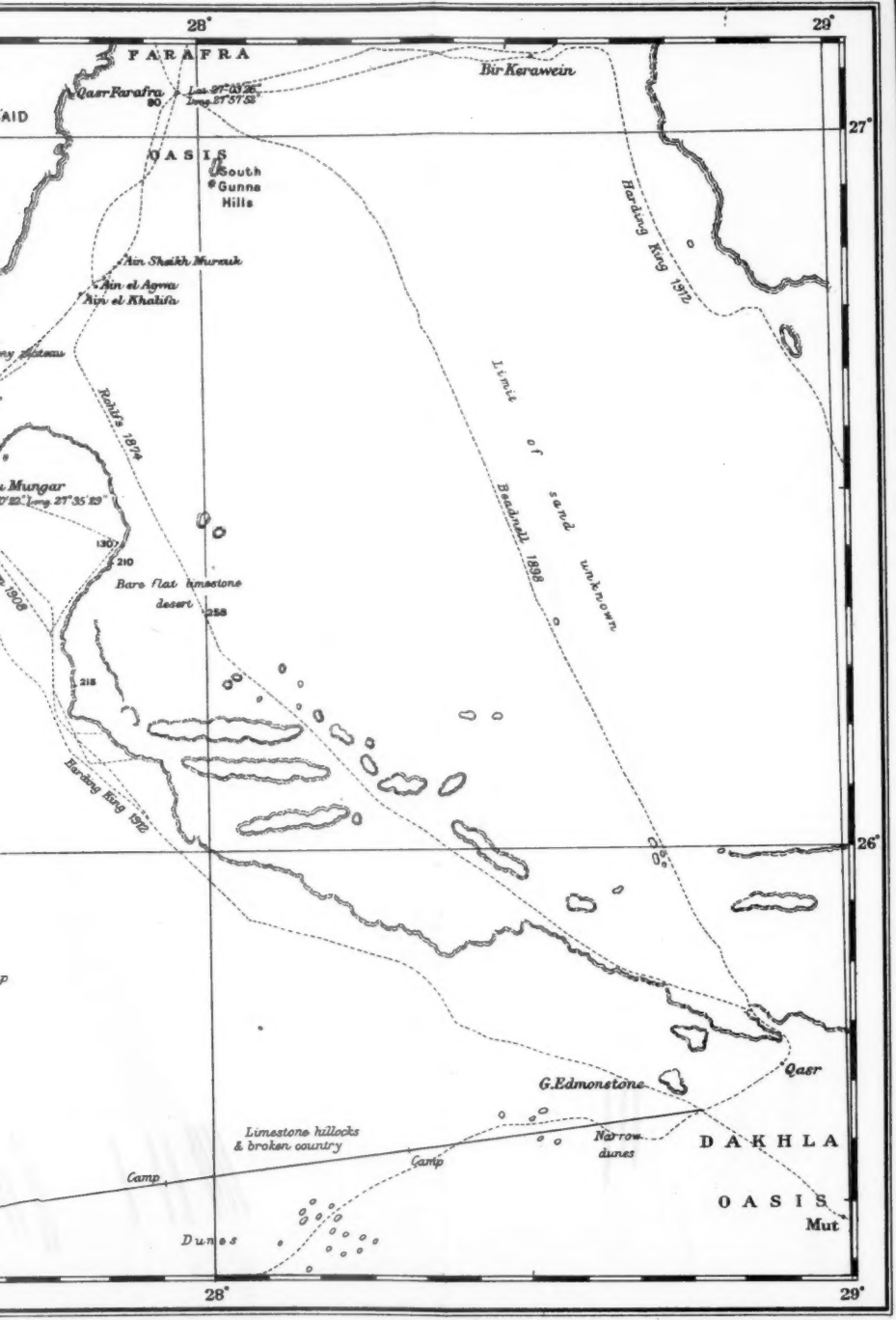

LIBYAN DESERT
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